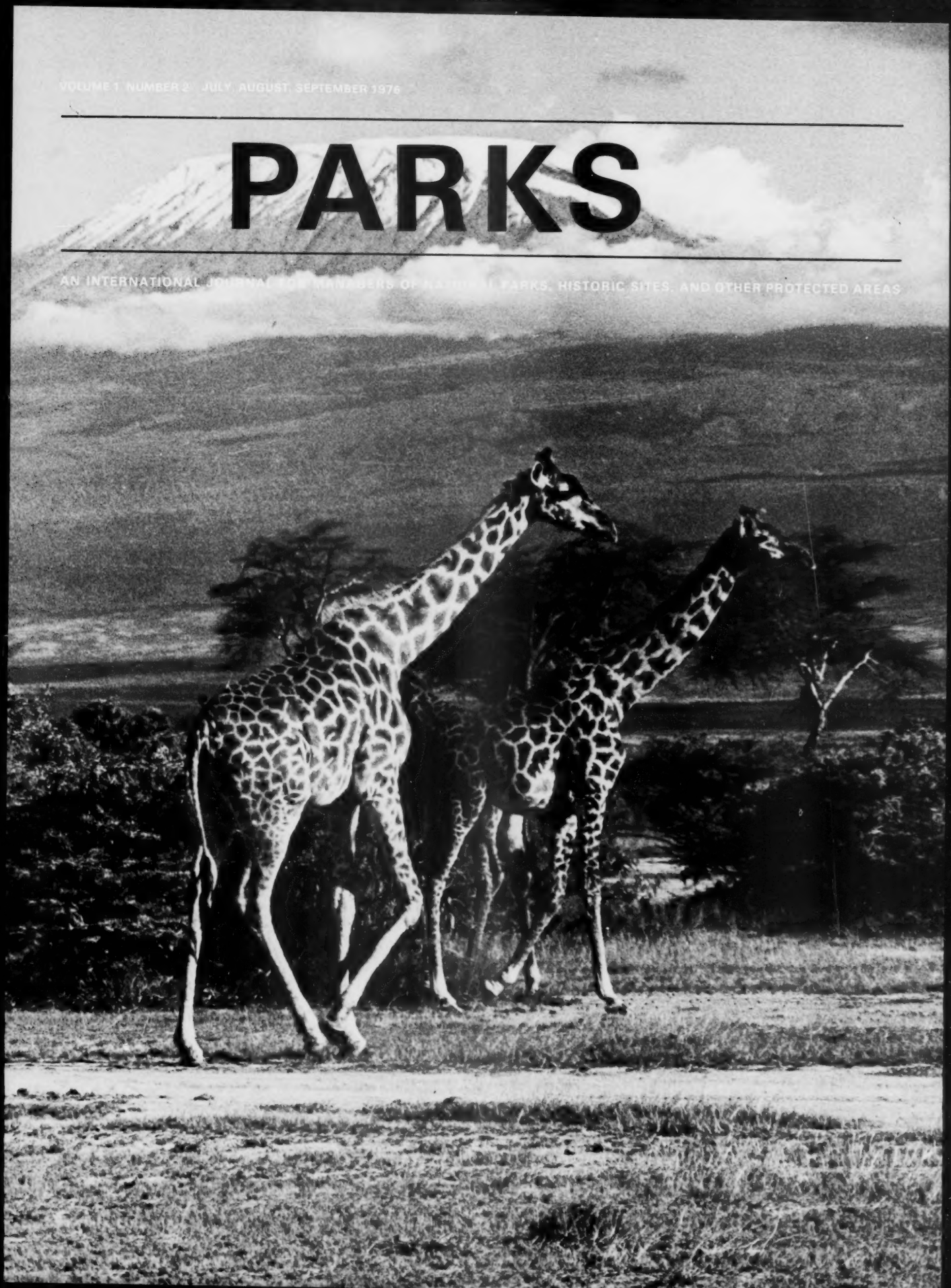
VOLUME 1 NUMBER 2 JULY, AUGUST, SEPTEMBER 1976

PARKS

AN INTERNATIONAL JOURNAL FOR MANAGERS OF NATIONAL PARKS, HISTORIC SITES, AND OTHER PROTECTED AREAS



PARKS

AN INTERNATIONAL JOURNAL FOR MANAGERS OF NATIONAL PARKS, HISTORIC SITES, AND OTHER PROTECTED AREAS

Volume 1 Number 2 July, August, September 1976

DAVID WESTERN 1 A New Approach to Amboseli
PAUL PHILIPPOT 5 The International Centre for Conservation
7 Information for Contributors
MARC J. DOUROJEANNI 8 Machu Picchu and Peru's National System of Conservation Units
VERNON C. GILBERT 12 Biosphere Reserves and National Parks
DONALD W. REESER 14 Successful Goat Control at Hawaii Volcanoes
15 More Countries Ratify Wetlands Convention

16 PARK PRACTICE
16 Trail Construction
20 "Language Paddles" at the Lowes
20 Something for the Children
21 Tree Trimming Guide
21 "Welcome House"
21 Something for the Birds
22 Marking Trails in Sand
22 Frustrating Relic Hunters
22 Standing Up to an Exhibit
23 Simple Clamps for Many Applications
23 A Firm Temporary Connection

24 PUBLICATIONS

Giraffes stalk through Amboseli National Park against the spectacular backdrop of Mt. Kilimanjaro. The area is famous for its wildlife, which includes elephants, black rhino, buffaloes, zebras, wildebeests, Grant's and Thomson's gazelles, waterbucks, oryxes, elands, lesser kudus, gerenuks, Coke's hartbeests and, of course, lions, leopards, cheetahs, hyenas, and many smaller animals. Photos: Mark Boulton

PARKS Magazine is an international publication for the exchange of information on the planning, use and management of the world's national parks and other protected natural and cultural resources.

PARKS Magazine is a pilot project of Parks Canada and the National Park Service of the United States. It is produced in collaboration with FAO, UNESCO and the Organization of American States (OAS), and with the cooperation of the Commission on National Parks and Protected Areas (IUCN) and Regional Advisors throughout the world.

PARKS Magazine is issued quarterly in separate editions in English, in French under the title PARCS and in Spanish under the title PARQUES. Controlled distribution of all editions is by mail. For information concerning subscription or publication of material please address:

The Editor
PARKS Magazine
c/o National Park Service
United States Department of the Interior
Washington, D.C. 20240/U.S.A.

PARKS printing costs are paid with donated funds. Ideas or viewpoints expressed do not necessarily reflect those of the sponsors, collaborators or advisors.

All material may be reprinted unless it is either protected by copyright or the material has been reprinted in this issue from an identified source publication. In such event no reprints are authorized except upon permission of the copyright holder or the source publication. Reprinted material should bear the author's name and credit to PARKS Magazine should be given. The Editor would appreciate two copies of any material so used.

The English and Spanish editions of PARKS Magazine are published in the United States with the cooperation of the Organization of American States and the Eastern National Park and Monument Association. The French edition is prepared and published in Canada by Parks Canada.

David Western

A New Approach to Amboseli

Integration of people, land, and wildlife seeks to end the conflicts which threaten this national park

The world-famous Amboseli ecosystem lying in the shadow of Mt. Kilimanjaro has a long history of human use. From at least the late Pleistocene hominids were attracted by the great abundance of large herbivores. Hunter-gatherers were succeeded by pastoralists some 2,000 years ago, with the Masai dominating the last 400 years.

Ecologically, the Masai mode of subsistence pastoralism has exerted a fairly constant and powerful molding force on the composition of the wildlife community.

Seasonal migration patterns and foraging strategies of Masai livestock and wildlife species are so similar that their niches are intermingled and inseparable. These involve a wet season dispersal phase and a dry season gravitation to the vicinity of permanent water and good late season forage of the Amboseli basin, a residual Pleistocene lake.

I think that some understanding of the historical interactions between Masai pastoralists and wildlife is a prerequisite to appreciating the attitudes and forces that increasingly will dominate the future of Amboseli, and similar parks at the local level. These are factors which should be recognized in the objectives, policies and plans of these parks.

Contrary to earlier views, there has been, traditionally, a positive use of wildlife by the Masai and other pastoralists, who have regarded these wild ungulates as "second cattle." In a run of good years livestock numbers were adequate to sustain the human population. During extreme droughts, however, such as that experienced in the late 1890's, livestock suffered high mortalities compared to wildlife. The recent 1973/74 drought brought cattle losses of about 40 percent as against a wildlife loss of only 3 percent. In these circumstances wildlife provide the main form of

Dr. David Western is ecologist and planner at Amboseli National Park, Kenya. His important long-term ecological studies are funded by the New York Zoological Society.

Much of the vegetation within the national park is still in an early successional stage. The lake which filled the Basin until about 5,000 years ago had no outlet and the high concentration of mineral salts it accumulated limits the productivity and diversity of plants. The soils are prone to wind erosion, the rate of which is accelerated by heavy natural and human use. Heavy use by livestock is featured in the trampled soils and sparse grass cover, and such use accelerates the natural, climatically induced trend to more arid conditions.

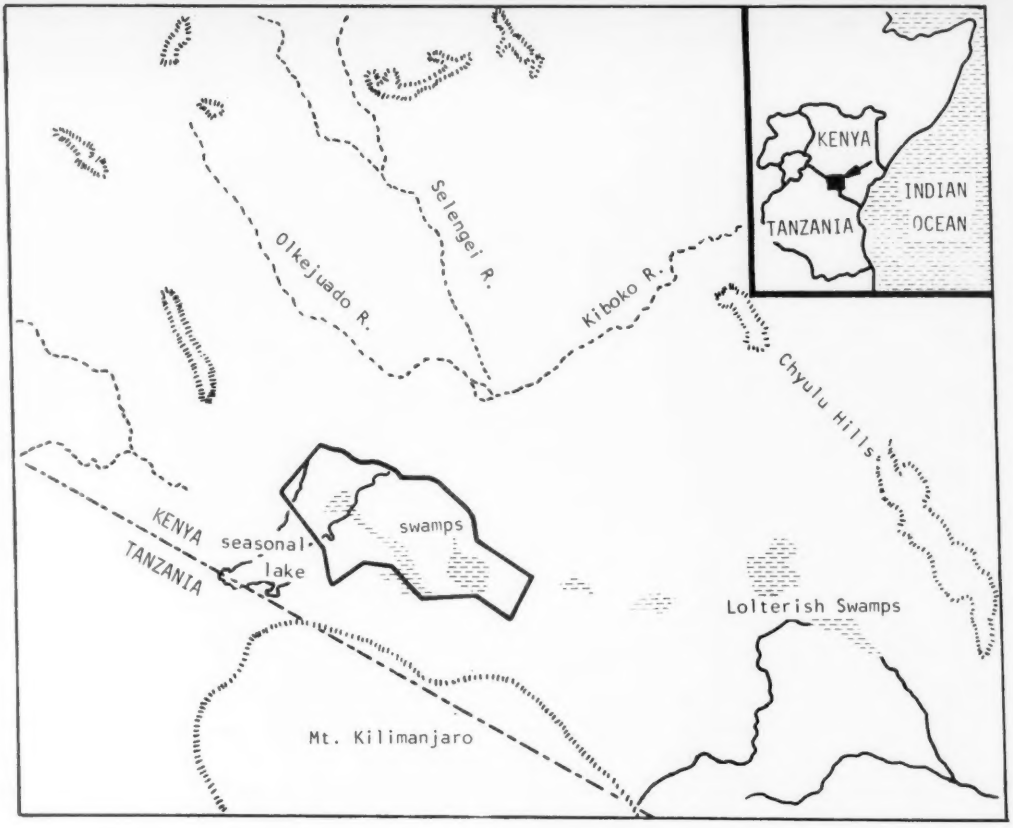


Fig. 1—Location of Amboseli National Park, which covers 150 sq. miles (388 sq. km) and lies at the northern foot of Kilimanjaro. The park boundary is surrounded by land that has recently been adjudicated as large scale ranches under the ownership of the traditional Masai occupants. Both Masai and wildlife are attracted to the two main swamps within the park during the dry season.

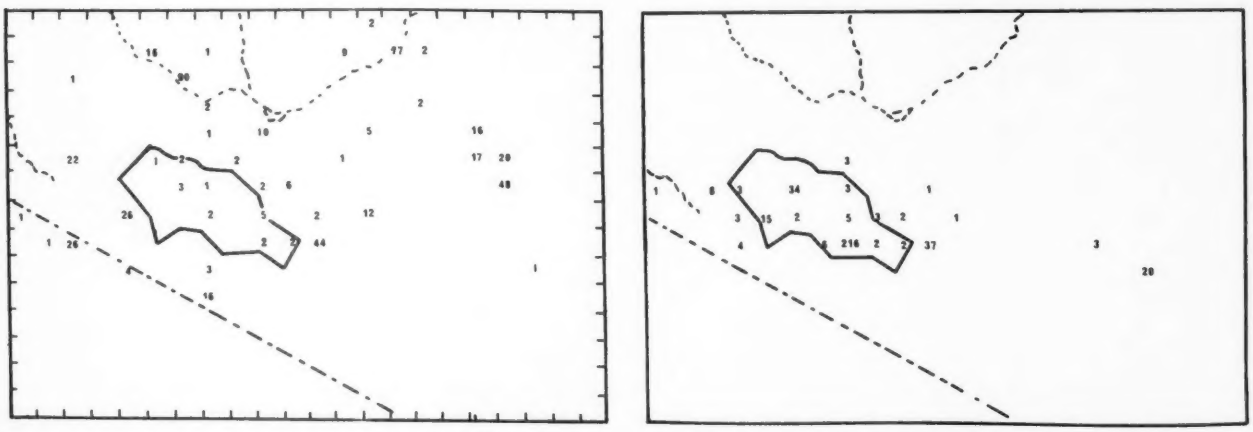


Fig. 2—Maps showing the seasonality in the use of the national park by one of the migratory species, the wildebeest. Left, wet season dispersal; right, dry season concentration. The figures are densities per square kilometer within each 25 sq. km cell, the coordinates of which are given on the left hand map. Aerial sampling is done routinely to monitor the ecology of the whole ecosystem. Note the extent to which the dispersal phase depends on the ranches beyond the park boundaries.

subsistence. This stop-gap use has long been a significant part of Masai subsistence, and this explains their tolerance of "alternative" cattle in the intervening years.

Conflicting demands and polarized attitudes

An integrated human/wildlife ecosystem can be contrasted with recent developments associated with development of Amboseli as a national park. Where once the ecosystem was a primary food source for people of the area, new demands have emerged which have different cultural and economic expectations. The Masai still look to Amboseli as their primary resource base, but at the regional and national level the park is seen as an asset which is expected to contribute to the national economic growth. At both the national and international level a growing body of people with adequate income and leisure time see the park as an aesthetic and recreational experience—a secondary resource. In the face of such conflicting demands Amboseli, and indeed similar parks in developing countries, are in danger of becoming battlegrounds of different interest groups.

The demand for the conservation of a wildlife resource, such as Amboseli, stems from the concern over its future viability under growing use by human and livestock populations. These are seen to exert greater demands on the ecosystem with which they were previously in balance. However, the act of changing Amboseli's status to a national park in order to conserve it transposes it from a primary to secondary resource. This moves its use from the local

In the last two decades the level of visitor use has risen at a rate of 25 percent per annum. Unconstrained service use has created a large number of unnecessary tracks and has resulted in increased vegetation damage.

to the national level at just the time when local people can least afford to do without the land or its wildlife.

The Masai see this move as changing the status of wildlife, their "second cattle," to that of "Government cattle" which can withdraw when grazing is short into the confines of government land—the national park. As a response to the restriction on their use of both animals and park land they see the only alternative as excluding wildlife from their own lands surrounding the park. This would block the migration routes, and restrict grazing to their own livestock. Such a polarization of interests is likely to increase now that the Masai have acquired legal title deed to their remaining traditional land around the national park. The present Amboseli plans are in response to such a disparity and aim at reestablishing the mutual benefits to both the Masai and wildlife within the ecosystem.

A plan to resolve conflicts

The basis of the present plans is to permit overlapping of the now separated interest of livestock and wildlife. Overlap can be accomplished by allowing a continued seasonal migration of wildlife over most of the Masai-controlled ecosystem, and through redistribution of revenues from the national park. This would compensate the Masai for some of the social and economic costs the park has imposed upon them.

This overlap, or joint wildlife-livestock use of the whole ecosystem, would, in fact, greatly benefit the park, and would be reflected in larger tourist revenue. When the park reaches its projected visitor capacity in the late 1980's, the Masai ranchers conceivably can earn 85 percent more than through a fully developed livestock economy. At the same time the national park, fully benefitting from the surrounding ecosystem, could expect some $1.1 million per annum compared with $0.5 million per annum if the park were to become an ecological island with the migration routes to the rest of the ecosystem cut off.

The selection and the size of the now gazetted Amboseli National Park was based on the rationale that it was not possible to change wildlife distribution, and that the 150 sq. miles (388 sq. km) set aside—the hub of the ecosystem—contained 90 percent of the wildlife biomass during the dry season. By contrast, the movement and production of livestock is more adaptable and can be complemented by resources and capital from elsewhere. Title to the land surrounding the park makes the Masai eligible for livestock loans, and guarantees against further land annexation for national park or other purposes.

The size of the land unit adjudicated to the Masai in the area surrounding the park was considered crucial for livestock productivity and the viability of the national park animals. Smaller land units would have meant a loss of livestock productivity since the Masai, along with the wildlife species, have evolved a system of livestock movements in relation to seasons that optimises the quality of food intake, essentially reducing the otherwise highly seasonal fluctuations. Moreover, this evolution had led to the recognition of a social unit of Masai which encompassed the ecological unit and operated as a single entity. From the wildlife conservation, social and economic aspects, a single ranching unit over the ecosystem was seen as more desirable than small units, especially since it would be easier to negotiate wildlife management and arrange for revenues to the land owners. By planning from this wide perspective it was possible to ensure the adjudication of a 300,000 acre (121,400 ha) tract of land that encompassed most of the Amboseli dispersal areas, and allowed the ranchers the flexibility of their traditional patterns of movement.

Theoretically, then, land allocation in the Amboseli ecosystem has been designed with the intention of allowing overlapping use and an institutional arrangement whereby it can benefit both pastoralists and wildlife. The major problem still revolves around how to effect an equitable distribution of the resources (such that the traditional mutual benefits can be reestablished.)

Distributing the benefits

There are two parties involved from the Masai standpoint. There are the regional County Council, which administers the 8,000 sq.

miles (20,727 sq. km) of Kajiado District, including the Amboseli ecosystem, and the local landowners. In the past almost all of the revenue from Amboseli has gone to the Kajiado County Council, and although this benefited the regional Masai, it did not filter back to those around Amboseli.

To allow for a continued regional incentive, 400 acres (162 ha) around the existing lodge was retained as Council land when Amboseli became a national park in 1974. This guarantees the future revenues from the lucrative tourist lodge. In addition a flat fee per year is now given to them for the severance of gate receipts. Both are unprecedented moves that have taken the Kenya National Parks into a new venture involving the external costs of a national park.

However, the most difficult problem is how to guarantee the local Masai an interest in that part of their traditional land resource which is now the park. There are various mechanisms by which this can be brought about, directly through revenue returns and indirectly through the provision of social services.

Economically the first situation to resolve is the disparity between the use of the area by livestock and wildlife. The latter are able to continue to use the whole ecosystem at the expense of the Masai landowners. The interim measure proposed is based on an ecological analysis of the amount of time the national park animals spend outside on the ranches; this has been translated into livestock numbers and the monetary equivalent calculated. Hopefully, this is to be instituted soon and will provide minimum guaranteed returns to the ranchers for the use of their land by park animals. It is, of course, difficult to calculate the substitution rate—an interim measure.

Meanwhile, more direct and profitable means of generating revenues are being negotiated. For example, campsites outside the park boundary can be of financial benefit to the landowners. Simultaneously, the park headquarters will be placed outside too, or at least at the edge, where, coupled with a community center, it will provide essential services to the ranchers as well as to the park's employees. Perhaps the single biggest source of income and incentive could be through the location of a lodge on the ranchers' land, with direct access to the park. All three proposals involve local participation, and aim to take pressure off the park. In less direct ways there are already benefits that the park provides, such as a market for handcrafts, and substantial employment. Hunting concessions are in the process of being established in the dispersal areas and, through a controlled offtake of wildlife, these will yield additional substantial revenues.

Direct revenues from wildlife should rapidly dispose of the need for a guaranteed minimum return, the interim plan, and should produce a very significant source of income. In the long term this would serve both the interests of the landowners and the national park.

The exclusion of the resident peoples from areas now in the national park depends on their being provided alternative water supplies. This will be completed in the next few months, through a project jointly sponsored by the Kenya Government, the New York Zoological Society and the World Bank. It is not only water alone that the Masai will be deprived of in the loss of the 150 sq. mile park area, but invaluable dry season forage from the Amboseli swamps. To compensate for this, part of the main swamp is to be withdrawn from the park and water from another diverted outside the park boundaries for Masai use. Even so, it is unlikely that, short of providing the ranchers with the sorts of benefits outlined, the compensation will be adequate. The operation depends on the externalities and a careful monitoring of the entire ecosystem to see how the changes emerge and what modifications, based on the available options, are needed.

Setting Capacity Limits

Management planning at the ecosystem level is regarded as setting the gross potentials of the national park: how many kinds and numbers of wildlife will be conserved. The actual potential of the park in terms of its visitor capacity and income will be affected in addition by the planning and management of it. In view of the varied demands on Amboseli there can be little doubt that the visitor flows are likely to add greatly to its future stability. But, the attraction of the area to visitors depends on its aesthetic appeal, and too much visitor use could reduce the park's value, clearly suggesting the need for a balance between economic and conservation interests. The future demands alone are likely to be sufficiently great that a capacity limit will have to be considered to protect the resource. Much of the internal management, therefore, centers on defining criteria for acceptable levels of visitor impact on the natural environment.

To a great extent the utilization patterns of the park depend on the visitors' own viewing demands, which at present are highly selective. About 30 percent of the average game viewing time is spent watching lions, and about 80 percent is spent watching lion, cheetah, elephant, buffalo and rhino, and consequently, the resulting pressure on rare and timid animals such as the cheetah is already causing concern. However, this does not mean that the visitor capacity has necessarily been exceeded, except under the present pattern of use. It is not only the highly selective viewing demands, but also the area of use—10 percent of the park is used 80 percent of the time—that contribute to the congestion.

The park plan now going into effect aims at dispersing both the visitor use of the area and diversifying viewing interests. By planning circuit designs on the basis of animal numbers and distributions on a seasonal and expected long term basis, it is hoped to establish the level of visitor use in any area to well within the natural tolerance of animals, habitat and terrain. The actual use of the zones can be further influenced by the introduction of better trained couriers and ranger-guides whose knowledge of the ecology of the area can do much to diversify the viewing interests of visitors.

Through setting up criteria for the design of the park, and by monitoring the results of animal, environmental and visitor impact, it should be possible to arrive at an acceptable definition of capacity that will serve the economic and conservation interests of Amboseli, at both national park and the ecosystem levels.

In trying to establish a set of policies and plans for Amboseli that will ensure the survival of its impressive wildlife community, it has been necessary to make a number of compromises between demands of a local or primary resource, and a national or secondary resource; between conservation and development, and between present and future use. In the setting of a developing country such as Kenya, a single over-riding socioeconomic trend does not exist, as it does in North America for example, with its increasing wealth, leisure time and demand for recreational and aesthetic pursuits. Instead, there are varied and changing demands, and national parks will have to be responsive to them if they are to conserve many of their existing ecosystems.

Paul Philippot

The International Centre for Conservation

A source for expert technical advice and services concerning preservation and restoration of cultural property

In many countries throughout the world national parks contain rich cultural treasures in addition to the spectacular natural resources they encompass. Park managers who are responsible for such property should know about the International Centre for Conservation. This is a major resource for expert technical advice and services concerning the preservation or restoration of this kind of property. Historic buildings and their surroundings, archaeological remains and excavations, and works of art or movable objects of every sort would be included.

The International Centre for the Study of the Preservation and the Restoration of Cultural Property (to give its full name) is an independent intergovernmental organization. Sixty-one nations are now members of the Centre, which was established in 1959 by UNESCO. Headquarters are situated in Rome through agreement with the government of Italy.

The Centre promotes contact with experts in conservation specialties, and provides training for young architects, archaeologists, restorers, art historians, museum curators, engineers, urban planners, and preservationists in an interdisciplinary and international concept of conservation. It also diffuses technical information at different levels. A secretariat of 16 permanent staff members carries out the Centre's program in consultation with an elected council.

The Statutes of the Centre direct it to exercise the following functions:

"a) collect, study and circulate documentation concerned with scientific and technical problems of the preservation and restoration of cultural property;

"b) co-ordinate, stimulate or institute research in this domain, by means, in particular, of commissions to bodies or experts, international meetings, publications and exchanges of specialists;

"c) give advice and recommendations on general or specific points connected with the preservation and restoration of cultural property;

Professor Paul Philippot is Director of the International Centre for the Study of the Preservation and the Restoration of Cultural Property.

A student at the International Centre works on a masonry wall at the Ozpizio di San Michele in Rome. Built in 1686-1790, restored areas of the huge building are occupied by the Centre.

Members of a class in the Fundamental Principles of Conservation prepare a laboratory culture for the study of microorganisms.

"d) assist in training research workers and technicians and raising the standard of restoration work."

This, in short, covers all the fields of cultural property and all the forms of activity likely to contribute to its preservation. Such a program is vast and open to endless extension. However, during the 16 years of its existence, the Centre has developed its own scientific capability, with personnel capable of the multidisciplinary collaboration now recognized as necessary to proper conservation.

The Centre's training program offers advanced specialization courses in different areas of conservation:

1) *Architectural Conservation:* a 6-month course given in collaboration with the University of Rome Architecture School. There are places for about 30 students who have academic degrees in architecture, art history, archaeology and related fields.

2) *Conservation of Mural Paintings:* a 4-month course given in cooperation with the Istituto Centrale del Restauro of Rome. This course has 15 places for students who hold diplomas from restoration schools or have at least 3 years of experience.

3) *Fundamental Principles of Conservation:* a 4-month course open to 14 curators, restorers or scientists. This course examines the properties of various materials and problems of climatology, especially light and relative humidity.

4) A two-week refresher course for museum curators, first given in 1975, deals with museum conservation problems: security, lighting, fire and climatology.

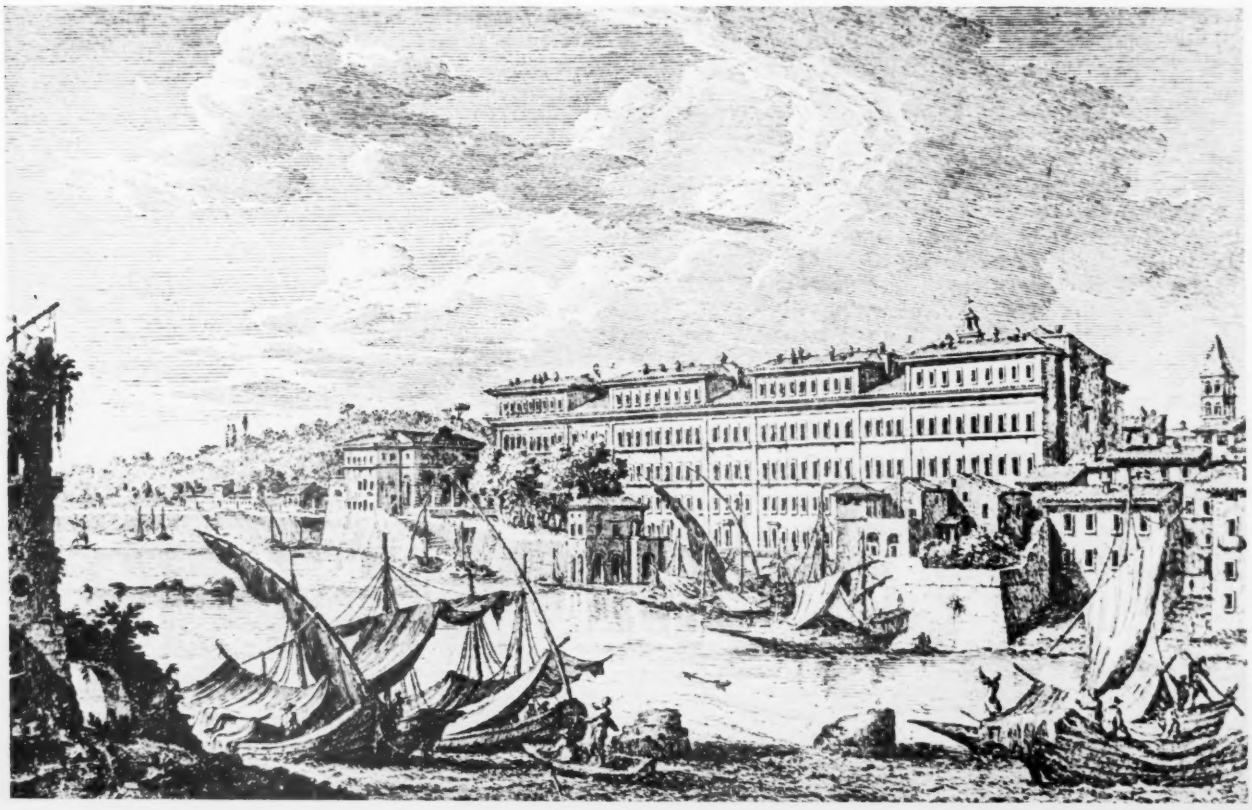
Except for the museum course, all the training is given between January and June each year. The Centre's premises in Rome are used for lectures and laboratory work, and considerable field work is also part of the program.

In terms of practical assistance, the Centre's modes of operation are quite varied and susceptible to still further development. The simplest form of assistance is generally answering requests for bibliographic information on specific subjects. However, an effective bibliography can only be established by a specialist informed on the subject in question. Thus one may progress from written information to information/assistance missions. To do this, the Centre must frequently call on outside experts, and this involves the establishment and maintenance of as complete a network of specialists as possible in different fields and regions. These contacts are facilitated by the close ties we maintain with specialists' associations such as the International Council of Museums (ICOM), the International Council of Historic Sites and Monuments (ICOMOS), and the International Institute for Conservation (IIC), and their national branches. Furthermore, the choice of the most suitable expert to handle a given task is often a delicate problem, in that one must take into account such variables as the exact nature of the problem, competence of the expert, language difficulties, etc.

Depending on the nature of the request, sending a technical expert to the site allows for a contribution to the solution of the problem on the spot. This may also lead to action such as forming a pilot work group to cover various aspects of the problem. Often, young experts can participate in these missions, perfecting their own experience while providing the country requesting assistance with more of their time than a better known, but overworked, expert could manage. Young local experts or technicians are also employed in these pilot missions and this also constitutes a form of advanced training which generally benefits all parties concerned.

An example of this kind of mission is the collaboration since

This old illustration shows portions of the Ozpizio di San Michele rising above the Tiber river in Rome. Part of the building is now occupied by the headquarters of the International Centre. Photo: Sergio Lucarelli



1971 between the Centre and the Turkish government on the problem of the rock churches of Göreme, in Cappadocia. After a preliminary reconnaissance mission, the Centre organized a study mission in 1972 along with the mural painting experts of the Istituto Centrale del Restauro in Rome, which enabled the conservation problems to be classified in three groups:

1) the problems of the mural paintings, which mainly concerned the adherence of the plaster to the rock and the penetration of rain water to the interior of the structures.

2) the structural problems of the rock masses in which the monolithic churches are carved.

3) the alteration of the rock on the external surfaces.

The structural problems of the rock were found to be more serious and required a thorough study of the local hydrogeological situation and mechanical forces to which the rock masses are subjected.

The Centre then informed UNESCO and the Turkish government of the type of experts thought necessary and suggested that, at the same time as the structural study was carried out, some urgent work on the mural paintings themselves could be done by a mixed pilot work group made up of international experts and members of the Antiquities Department of Turkey. In 1973 and 1974, two such missions, each about 45 days long, were carried out. The participation of Turkish specialists in the work has ensured the gradual training of a local team which should soon be capable of maintaining the paintings during the period necessary for the consolidation of the structures. Studies on the hydrogeological problems are going forward and should result in a stabilization project for two of the churches and eventually a conservation plan for the site as a whole.

In other cases, the Centre acts as an intermediary for particularly delicate restoration work, calling on national institutions or experts with special experience. For instance, the original *mirhab* of the Kairouan Mosque was restored at the Istituto Centrale del Restauro in Rome, and a Punic polychromed wood sarcophagus discovered in Kerkouane, Tunisia, was restored in the laboratory of the Swiss National Museum at Zurich. The experts responsible for these operations also participate in the Centre's training program.

In all of these activities, the Centre itself cannot undertake large-scale restoration work as its function is one of consultation and training. Such work as is done is mainly to get things started or to demonstrate proper methods. Our ultimate aim is to help each country acquire the information and means to realize the conservation of its cultural patrimony with its own services and with its own experts.

Experience has shown that contact with different cultures is as necessary today as advanced specialization in order to understand and judge one's own culture and its problems. In this respect, the training and meetings organized by the Centre offer an exceptional opportunity. Here Rome, for the richness and incomparable density of the historical layers still visible and present in its daily life, adds unique and fundamental experience for all those whose vocation is a dedication to the comprehension of the past, its integration in the present, and its safeguard for the future.

Information for Contributors

PARKS magazine is published in three languages and is distributed throughout the world. It is edited primarily as a technical and management journal for national park personnel, and deals with natural, historical and cultural matters pertaining to national parks and other protected areas. All aspects of planning, management, use, and operation of these areas are subjects considered for publication.

Authors are usually professional people engaged in park management, or in the many disciplines associated with parks and protected areas. Normally authors will be invited to write on subjects selected by the editors, but those who have ideas based on their own experience who would like to submit articles of not more than 1500 words for consideration are requested to write to the Editor before preparing manuscripts.

Unsolicited original manuscripts are also welcomed for consideration by the editors. Such material will not normally be returned to its sender unless this is specifically requested.

Manuscripts may be submitted in English, French or Spanish.

Suitability for publication is determined by many factors. These include factual and technical content, timeliness, and potential value to our international audience.

Authors will be advised as promptly as possible if their contributions are accepted for publication. In most cases, several exchanges of correspondence should be expected since all manuscripts must be edited. This may involve text cuts or additions, and changes required by translation needs and understanding by an internationai audience.

It must be understood that publication cannot be guaranteed. There may even be instances where manuscripts that have been accepted and edited are withdrawn from the publication schedule.

PARKS magazine is not copyrighted. Material protected by copyrights held by authors will be considered for publication, however, provided suitable assignment of the right to publish is made to us.

Payment is not normally made for articles or photographs.

Manuscript preparation specifications will be sent on request.

Marc J. Dourojeanni

Machu Picchu and Peru's National System of Conservation Units

Machu Picchu, without a doubt, is one of the world's most important architectural gems and a leading South American tourist attraction. In Peru, as well as in other countries, there are ruins that rival and even surpass it in beauty, but not one in the Americas and, for that matter, very few elsewhere so wonderfully blend human handiwork and natural scenery. Machu Picchu, a fortress or shrine whose origin remains shrouded in mystery, is located in that region of Peru which is at once a part of the Andean area and a part of the Amazonian wilderness. There the warm, sensuous greenery of the humid tropical forests merges with the steep mountains of the eastern range whose snowy peaks may be seen on clear days. This was the farthest point reached by the proud Inca warriors on their march toward the east, the Incas who, despite their immense power, failed in their endeavor to subjugate the free inhabitants of the "warm lands", the natives of Amazonia.

Machu Picchu is by no means a place where nature is found in its virgin state. The region's ecological systems have undergone profound changes which began many centuries ago. Still, important values remain, such as the flora and fauna which are fairly representative of the natural zones to which they belong. However, the reason why there has been so much talk of establishing that area as a national park, or a reserve which would be equivalent thereto, is, essentially, the idea of conservation of the splendid landscape which the Incas chose as the site for one of their most important works, and the remarkable historic structures which remain.

There are, in fact, clear signs of the harmful effects of the primitive farming which has been carried on in the immediate vicinity of Machu Picchu's ruins and other nearby ruins. The irrational exploitation of forests, the systematic burning of vegetation in order to create pastures that could only be skimpy, at best, and to set up an infrastructure for water power, highways, and tourism, are rapidly wasting away the basic aesthetic values which have brought about the area's well-deserved fame.

The creation of an official conservation unit in such a place poses extraordinary problems, not only from the standpoint of control over prohibited activities and the restoration of equilibria, but also, in particular, deciding what kind of unit it should be, taking into account the degradation of the area, the impossibility of eliminating all the factors which contribute to further deterioration, and the existence, elsewhere in Peru, of absolutely undisturbed examples of the same ecological systems.

Peru's national system of Conservation Units

Since 1970, the creation of conservation units in Peru—that is, national parks, national preserves, and national and historic shrines—has been, basically, with a view to the preservation of representative examples of all of natural life zones or of the main ecological systems found within the country's borders, including its territorial seas (Grimwood 1967 and Dourojeanni 1973). As a result of this goal eleven conservation units which comprise altogether 3,833,415 hectares have been established and another six units are to be set up in the near future. When all of these units have been added, 4.7 percent of Peru's mainland will have been given over to protecting its most important biomes.

Table No. 1—The Conservation Units established in Peru, and the principal ones to be established in the next few years (marked with asterisks), will protect 6,175,385 hectares, or 4.7 percent of the national territory.

Conservation Units	Surface Area (Ha)	Year Established
National Parks		
Cutervo	2,500	1961
Tingo Maria	18,000	1965
Manu	1,536,800	1973
Cerros de Amotape	91,300	1975
Huascaran	340,000	1975
Cutibireni*	235,400	
Loreto*	2,000,000	
National Reserves		
Pampa Galeras	60,000	1967
Samiria-Pacaya	1,387,500	1972
Junín	53,000	1974
Paracas	335,000	1975
Lachay*	5,070	
Titicaca*	50,000	
National Sanctuaries		
Huayilay	6,815	1974
Huaros*	1,000	
Historic Sanctuaries		
Chacamarca	2,500	1974
Machu Picchu*	50,500	

Dr. Marc Dourojeanni is Senior Professor at the National Agrarian University at La Molina (Lima) and Director General of Forestry and Fauna, Ministry of Agriculture, Peru.

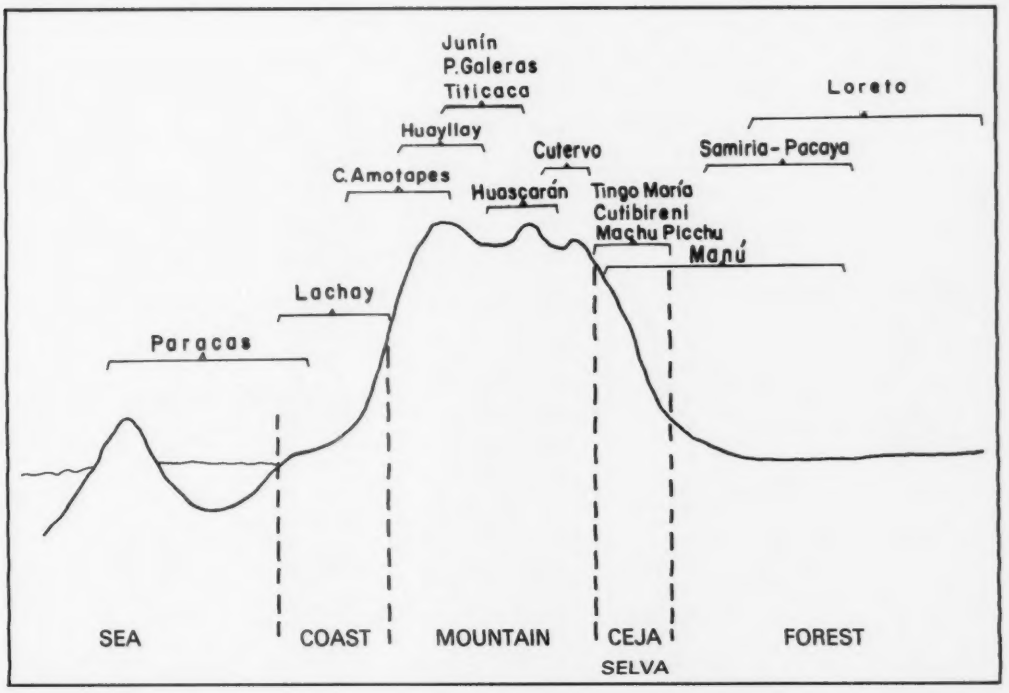


Fig. No. 1—A horizontal cross section of Peru showing, schematically, the coverage of the National System of Conservation Units.

Machu Picchu as an historic site

The ruins of Machu Picchu were discovered and explored in July, 1911, by Hiram A. Bingham, who headed a scientific expedition from Yale University. Earlier explorers had been close to Machu Picchu but failed to discover it. The site embraces an irregularly shaped area covering approximately 5 square kilometers, 114 kilometers distant from Cuzco following the Cuzco-San Ana railway line. It lies on the left bank of the Vilcanota river, at 2,690 meters (8,825 feet) above sea level, on a mountain that is difficult to climb because of its exceedingly steep grade.

The ruins lie atop the mountain and are surrounded by a wall 5 meters high and 1.8 meters wide. There are 109 stairways connecting the terraces and buildings, many of them carved out of underlying rock, and they have more than 3,000 steps. Particularly beautiful are the striking monuments known as the Large Military Tower, the Royal Chamber, the Palace of the Princes, the Sector of the Seventeen Fountains, the Sacred Square and the Great Temple, the Temple of the Three Windows, and the Intihuatana (Rozas, 1954). Next to Machu Picchu, one finds the Huayna Picchu, a high peak which is reached by following a narrow path and from whose summit one can view an imposing panorama of the forest and snow-clad mountains.

South of Machu Picchu lies a highly important archeological area which contains, among others, the ruins of Intipata, Llactapata, Huiñay-Huayna, Coquesuysuy, Phuyu Putu Marca, Chachabamba, Runca Racay, and Sayac Marca. Discovered between 1940 and 1942, they are now visited by a large number of tourists who travel on foot, from Cuzco, over the cobbled roads built by the Incas.

Machu Picchu is not believed to date from far back in antiquity. Engel (1972) holds that it was the Inca Pachacute (1438-1471) who extended the empire's frontier to Machu Picchu or, at least, to Ollantaytambo, to protect the fertile lands of the valley of the Urubamba which had been conquered as a source of supplies for Cuzco.

In order to preserve the archaeological site, a reservation of 10,724 hectares has been established surrounding it to form what is termed an archaeological park, within boundaries drawn by the National Cultural Institute. Unfortunately, this type of reservation does not protect the area effectively against the environmental impact of agriculture and cattle breeding, or from the exploitation of natural resources.

Machu Picchu — Tourism

In 1974 the ruins were visited by more than 80,000 tourists. Annual increases are estimated at 13.6 percent. Two-thirds of the visitors come from abroad.

Tourists are drawn to Machu Picchu by the incomparable beauty of the scenery and monuments. Both are closely linked, and an indescribable sense of mystery overpowers all who enter the citadel. It is so well preserved that it seems to have been abandoned only a very short while ago. The deep chasms and hazardous cliffs surrounding it further impress visitors.

At present the services provided to tourists are modest and inadequate. There are uncomfortable cars of an exceedingly slow train, long waits to go by bus up from the station to the ruins, an old and small hotel whose dining-room seats too few. These conditions will be changed by the construction of an asphalt road from Cuzco to Machu Picchu, addition of a modern hotel close to the ruins, and probably a cable-car installation. Although it is assumed that these facilities will not prove detrimental to the scenery, nonetheless they would be a departure from Peru's policy of not allowing this type of construction within the boundaries of its national parks and shrines.

The investments that are being put into developing tourism underscore the need to diversify Machu Picchu's tourist facilities so that visitors will tarry longer. Particular thought is being given to the hotel. Ecological considerations are being included to prevent avoidable damage to the environment. The need for stronger control over these aspects is seen as justification for creating a conservation unit.

The citadel of Machu Picchu, a spectacular remnant of the empire of the Incas, crowns jungle-clad Andean heights at 8,000 feet (2,440 m). Peru is considering action to further protect this remarkable landmark as part of mankind's cultural and natural heritage. Photo: Canadian Pacific Railway.

The excellent state of preservation of Machu Picchu's structures is shown in this picture. Note the stone walls and terraces. The peak of Huayna Picchu rises in the background. Photo: Marc Dourojeanni.

Natural Machu Picchu

According to the ecological map made by Tosi (1960), the area that could constitute a conservation unit comprises at least six life zones ranging from nival formations down to a low-lying humid mountain forest. The altitude of the 50,500 hectares (124,785 acres) considered in the project area varies from over 5,000 meters (16,400 feet) down to 2,000 meters (6,500 feet) above sea level. Consequently, the flora and fauna are exceedingly varied, but not abundant due to exploitation and harmful land use practices.

The fauna is typically that found in the *ceja de selva* (See Fig. 1). One should mention the presence of the spectacled bear (*Tremarctos ornatus*), the rock rooster (*Rupicola peruviana*) and, possibly, the dwarf deer (*Pudu mephistopheles*), all rather rare. Among other known existing mammals are otter, monkey, puma, ocelot, great anteater, sloth, wild horse, and deer. There are several kinds of rodents too. Birds are quite numerous, and prominent among them are the Andean condor, river ducks and various species of *Cracidae* and *Psittacidae*. Because agricultural practices have

increased rodent populations, snakes which feed on them are abundant, including the poisonous *Bothrops* and *Micrurus*.

In general terms, the fauna has been decimated as a result of hunting and of the destruction of essential habitat.

The flora has undergone profound and probably irreversible changes. Despite the fact that the steep terrain and great precipitation make the area undesirable for agricultural pursuits, much has been cleared for farming and cattle breeding, and as a result the well-known processes of migration as well as rapid erosion have set in. The only way in which these slopes can be worked is by doing as the Incas did, that is, building terraces or platforms, and not by digging furrows on open slopes as is done now throughout the mountain range. The deterioration of the pasture lands is to be seen in the abundance of the *Pteridium* fern, a sign of an unceasing burning of lands. On the other hand, exploitation of the forests has been intense. Construction of the railway caused the almost total disappearance of cedar (*Cedrela*) and ulcumano (*Podocarpus*) trees, which were cut down in great numbers from 1940 to 1965, and as with other species, used to make railroad ties. Below the ruins, in Mandor, cedar trees measuring two meters in diameter have been cut down, on lands where only feeble cattle now graze.

However, it is evident that in the steepest places the original flora still survives and a gradual replanting of the former farmlands and pastures seems possible. Vargas (1969) mentions the existence of 30 genera and more than 90 species of *Orchidaceae* in the immediate vicinity of the ruins.

A further difficulty in the project area is that of land ownership. Many large estates were turned over to the *campesinos* under an agrarian reform program in 1966. This has caused a conflicting situation for the project, particularly if there is thought of establishing a national park.

A look at alternatives

Machu Picchu undoubtedly deserves the highest priority of protection in order to preclude deterioration of its tangible and intangible values which constitute a precious legacy for all mankind. If, as evidence indicates, establishing a conservation unit is the best manner in which to put an end to the present deplorable situation, then considerations of an alternative definitely take second place. That is, Machu Picchu must be protected despite the fact that there is no definite proof that it is better endowed than Cutervo, Tingo Maria or Cutibireni, or many other areas that are practically in a virgin state and are ecologically similar. This is true in spite of its close proximity to Manu National Park, which does enjoy optimum conditions for its legal status. Moreover, Cutervo and Tingo Maria are justified because of the protection they afford to the oilbird or guacharo (*Steatornis caripensis*) and because they are the oldest national parks in Peru, while Cutibireni is secure because within its boundaries are several spectacular waterfalls that are unique. In other words, the *ceja de selva*, because of its peculiar conditions, would rate a certain number of conservation units that otherwise would not be justified in the case of Peru, a country in which the first steps in conservation activity are now being taken.

The definitions of conservation units given in the new Forestry and Wild Fauna Law of Peru (1975) make it difficult to choose the type of unit that should be established in Machu Picchu. On one hand, the national parks and shrines as well as the historic shrines are inviolable—that is, in theory, the land involved is reserved for the state in order to eliminate any kind of economic speculation; on the other hand, the national reserves—which in themselves are compatible with other forms of land use, including farming and cattle breeding—are clearly for the protection and propagation of species of wild fauna that are of national interest. National reserve status would not hold in the case of Machu Picchu, not as a national park or shrine at least until the problem of land tenure is solved.

There remains, therefore, the status of a historic shrine (and that of a national park, if the State can guarantee the area's inviolability). The term "historic shrine" has been used only once in Peru, for the new National Shrine Chacamarca, in protecting the site in Junín where the patriots and royalists fought during the War for Independence. The idea of protection in such cases does not refer to nature but to the usually modified landscape of the place where the historic event took place. This criterion is entirely applicable to Machu Picchu and would not be an obstacle to the establishment, by means of a long-range plan, of strict control over harmful human actions. It would, instead, tend to reduce or eliminate such actions altogether, and help advance restoration of damaged natural areas.

In conclusion, the creation of a conservation unit in Machu Picchu entails peculiar problems of its own. Peru possesses a great deal of land, some of it remote and almost intact while some has been occupied by humans for thousands of years. In either case, the establishment of conservation units is based primarily upon scientific considerations. In the case of Machu Picchu it is a question of coordinating the conservation of renewable natural resources and the duty of preserving the historical heritage and presenting it in the best manner possible before the eyes of mankind. It poses a new problem for us. One hopes that the Peruvians of the twentieth century have the ability to merge man's handiwork and nature as efficiently as did the Incas in Machu Picchu.

References

Dourojeanni, M. J. 1973. Fundamentos y ejecución del programa de parques nacionales y reservas equivalentes del Perú. In *II Taller Internacional sobre Manejo de Áreas Silvestres*. Iguazu, Argentina, 21 January-8 March, 1973

Engel, F. A. 1972. *Le monde precolombien des Andes*. Hachette, Paris.

Grimwood, I. R. 1967. *Recomendaciones para la conservación de la vida salvaje y el establecimiento de parques y reservas nacionales en el Perú*. British Ministry for Overseas Development, Lima.

Perú, 1975. *Ley Forestal y de Fauna Silvestre (Decreto Ley No. 21147, 13 de mayo de 1975)*. Ministry of Agriculture, Lima

Rozas, E. A. (Ed.) 1954. *Cuzco, ciudad monumental y capital arqueológica de Sud América*. Cuzco, Peru.

Tosi, J. A. 1960. Zonas de vida natural en el Perú. In *Boletín Técnico No. 5*. Instituto Interamericano de Ciencias Agrícolas; Zona Andina, Lima.

Vargas, S. 1969. *Flora ornamental de Machupijchu*. Universidad Nacional del Cuzco. Cuzco, Perú.

Vernon C. Gilbert

Biosphere Reserves and National Parks

In those well-watered, fertile or sparsely inhabited parts of the world the idea that the Earth's productive mantle, the biosphere, could be in trouble seems but a wild notion. But one does not have to look very far or very wide to find damage. Vast areas are virtually unproductive. Deserts are spreading, forests disappearing, while pollution moves insidiously into every part of the globe.

What caused—and is causing—this trouble? Conservation scientists are virtually unanimous in placing the blame on the twin evils of too much consumption of resources, and too little care in the way they are obtained and used. These evils are centuries old, of course.

The Repetek Reserve is one of the first biosphere reserves designated by the USSR. The reserve protects flora and fauna of the sand desert region of the famous Karakum desert of the Turkmen SSR in Central Asia. Here a research station is the center for extensive studies on desert ecosystems. Information from the station is being shared with other countries.
Photo: Vernon C. Gilbert

Efforts to "do something" about the situation are not new either, but truly international activities toward corrective action, and basic conservation, are relatively recent.

One major effort is UNESCO's "Man and the Biosphere" program (MAB), which is a series of far-reaching study and action projects. More than half of the world's countries are now cooperating in this intergovernmental, interdisciplinary effort to develop solutions to common environmental problems.

The development of a world-wide network of protected areas, or "biosphere reserves", for the conservation of species diversity and for use in ecological research, monitoring, training, and education is the focus of MAB Project No. 8, "Conservation of Natural Areas and of the Genetic Material They Contain."

As of mid-June 1976, a great deal of progress had been made toward the development of this world network, with some 40 countries proposing more than 200 areas to be designated as Biosphere Reserves. Also, several countries in planning their national programs have entered into bilateral and regional cooperative projects. The 1974 agreement between the USA and the USSR is one example.

The biosphere reserve program involves three stages. The first determines the status of conservation of representative ecosystems and to recommend areas which should be included. Second, countries designate and establish suitable areas, according to established criteria. Third, these reserves, which remain under national administration and control, become bases for sharing information and expertise in a coordinated international program of conservation, research and training. This, of course, has the potential of strengthening national efforts in natural resources conservation and management.

Two general categories of biosphere reserves have been defined.

1. Natural ecosystems where human influence is slight. These can be ecosystems which are representative of major biomes or biome sub-divisions or unique areas or ones with unusual biological features of particular interest; and

2. Man-modified ecosystems. These can be landscapes which have long-established patterns of harmonious and stable use, or degraded areas if they are of scientific value for the species involved and for the study of processes of recovery.

A biosphere reserve has to be large enough so that the diversity of species which interact with each other can be conserved on a long-term time scale. This implies also that each biosphere

Vernon Gilbert, a U.S. National Park Service ecologist with experience in Africa and with UNESCO's Division of Ecological Sciences in Paris, is U.S. coordinator for the Man and the Biosphere Program.

Everglades National Park at the southern tip of Florida is one of many biosphere reserves set aside by the USA. Vast areas of shallow fresh and brackish waters are the home of a rich variety of plant and animal life. NPS Photo: W. Williams

Another US biosphere reserve is the 1.3 million-hectare Glacier Bay National Monument. Its resources include 16 active tidewater glaciers. NPS Photo: John Kauffmann

*Puerto Galera biosphere reserve on Mindoro in the Philippine Islands encompasses 143 sq. miles (370 sq. km) of hilly forest, lands used for shifting agriculture, swamps, groves, islands and a variety of marine ecosystems. Rare endemic species found there include the Tamarau (*Anoa Mindarensis*). Photo: Robert E. Nelson*

reserve must be protected by appropriate government authority (federal, provincial or local) and have an adequate and sound legal basis.

All three of the stated objectives—conservation, research, and education—and the different categories of biosphere reserves, are important. Priorities between them, however, will vary according to national needs.

Relationship of Biosphere Reserves and National Parks

The Biosphere Reserve Program is not meant as a substitute for programs to establish national parks or similar reserves although biosphere reserves may often coincide partly with or incorporate national parks. The major characteristics distinguishing reserves from parks are as follows:

1) The biosphere reserves, while under a country's sovereign control, are intended to be a part of both the national and intergovernmental MAB Program. As such, they provide bases for MAB research in which governments share involvement in cooperative projects. In general terms MAB Projects are concerned with research on impacts and ecological effects of human activities on different biome types such as tropical forests, islands, mountains and tundra. Expert Panels for these MAB projects have often emphasized the need for further studies of natural ecosystems, and for comparison studies of modified ecosystems. Biosphere reserves, therefore, are basic logistic resources for some of the research to be undertaken in MAB, and in some cases such activities are not possible within national parks.

Suitable biosphere reserves may also serve as baseline stations as part of the Global Environmental Monitoring System (GEMS) of the United Nations Environment Program.

2) Biosphere reserves may include areas which would not be suitable as national parks. These could be areas of insignificant scenic attractions, or areas which have become degraded. The biosphere reserve, for example, could include an entire island which has long been occupied and used by man in a stable and productive way, and which will continue to be used in the same manner as a function of its status as a biosphere reserve. Such areas have value for studies such as re-colonization, land stabilization and restoration of genetic diversity.

The biosphere reserve approach to conservation has been questioned by persons who prefer a system of strict nature reserves. However, it is strongly felt that protection of nature reserves will result in only limited ecosystem preservation. The use of such areas must lie not only in preservation, but in the research and monitoring of man's actions to determine which actions are compatible with maintenance of viable ecosystems, and which actions must be changed. Clearly, the standard must be basically ecological, not just socioeconomic, however important that may be.

The biosphere reserve philosophy is a rational approach to long-range conservation of natural areas and genetic materials. Matters of size, "carrying capacity", and use of reserves were addressed by the Expert Panel on MAB Project 8. They concluded

that with the natural and economic limits to conservation, completeness of coverage to safeguard as many species as possible is less realistic and relevant than the soundness of systems of conservation.

Further, protection of reserved areas and certain uses of the areas can be compatible with, or in some cases even essential to achieving broader conservation objectives. The point is to keep human impact in reasonable bounds. As the Panel notes, "Infringement of ecological and genetic integrity must be balanced against long-term security of tenure: conservation is, and is likely to remain, uncertainly poised at the will of any generation, community or government. Moderate access for our dominant human species may result in exchanging a bearable loss in biological integrity for a gain in size, diversity and security of reserved areas."

The Panel also suggests that with regard to long-term conservation efforts "perhaps our greatest difficulty stems from the contradictions of time scale: evolutionary time is compressed into historical time and made subject to decision-making on a socio-political time scale."

Since current public interest guides the politician in the socio-political time scale, the hope for long-term conservation lies with a greater public awareness of the fact that rational management of natural areas and genetic material is vital to nations and to the world. Hope must also lie with politicians' willingness to implement cooperation among nations in programs such as MAB.

Such cooperation, although slow in beginning, now looks encouraging. At the last session of the UNESCO General Conference, where some 130 governments were represented, MAB received unanimous support. This is not to imply that there are not major difficulties in implementing a program of the scope of MAB and the development of a world network of biosphere reserves. It can only be done with the understanding and help of political leaders who will have to accept and defend the program.

Fortunately, national parks are generally recognized as a highly desirable form of ecosystem conservation, politically acceptable and usually offering important socioeconomic values. Park systems therefore are of particular importance to the MAB program, and it is hoped that park managers and their governments will take steps to bring parklands which do qualify into the world network of Biosphere Reserves.

Donald W. Reeser

Successful Goat Control at Hawaii Volcanoes

Hawaii Volcanoes National Park was established in 1916 to preserve, in part, native Hawaiian flora and fauna. Park managers responsible for carrying out this policy have persistently been plagued by feral goats (*Capra hircus*). The destruction these animals have done to Hawaiian ecosystems, which evolved in the total absence of four-footed herbivores, is well recognized. First introduced in Hawaii in the late 18th century, goats have been a major contributor to the endangerment or extinction of hundreds of endemic plants and birds.

For nearly 50 years the National Park Service waged a losing battle to reduce the devastating effects of goats on 80,000 acres (32,376 ha) of park terrain. During this period the goat population went up and down commensurate with the reduction pressure applied. A total of over 100,000 goats were removed, but at no time was herbivore pressure on native plants alleviated. Goats proved to be a formidable foe, tenaciously holding on to the land, making its restoration impossible. Their high reproductive rate coupled with the ruggedness and inaccessibility of the park terrain, counteracted the most aggressive control efforts.

By 1970 it was clearly evident that past techniques of round-ups and hunting alone would never solve the problem. Merely "controlling" the population would never permit native plant and animal communities to be maintained. Even a relatively low goat population in a given area could selectively crop all native plant regeneration, leaving many unpalatable, browse-resistant, exotic weeds to compete advantageously. Meanwhile ecological studies of small fenced exclosures were demonstrating that, with goat pressure eliminated, many native plants would regenerate. One exclosure near Kukalauula provided the most dramatic evidence of this. Two years following its construction 50 percent of the regenerated plant cover inside the fence was native, including a species of Hawaiian bean previously unknown to botanists. Outside the fence, however, the ground was virtually bare, with only patches of closely cropped exotic grasses.

Based on exclosure studies and past experience, park managers began to recognize that adequate fencing, both boundary and internal, was probably the key to solving the goat problem in a socially acceptable manner. Therefore, in 1971, park-wide control of feral goats was curtailed, and available funds were used to begin an internal fencing program. Woven wire was used, four feet high (122 cm) and strung on steel posts. Fences were built so as to leave the landscape unmarred; no bulldozers were used; fences had to conform to the uneven terrain. The first project completed was a 3,000 acre (1,214 ha) unit in which goat roundups for live sale were conducted, and followed by a three month period of concentrated hunting pressure by park and deputy ranger personnel. The last few goats remaining required extraordinary effort to remove, far beyond the point of diminishing returns, but there was no giving up until every goat was gone—an impossible task if it had not been for the fences.

Although costly, this approach was effective. Consequently,

Donald Reeser is Management Ecologist at Hawaii Volcanoes National Park.

more internal fences were built in strategic locations. By this method, over a four year period, goats have been systematically removed from most of the park. Fences along the boundaries of the park, necessary to prevent re-invasion, are 60 percent complete.

An aerial goat census in January, 1971, gave an estimated population of 15,000. The latest census in January, 1976, estimated the population at 1,200. It is expected that by January of 1977 the park will be virtually goat free. With the regeneration of vegetation in large areas of the park, positive resources management projects are now feasible. The reintroduction of the endangered Hawaiian goose (nene) and the reestablishment of many rare and endangered Hawaiian plants are programs successfully being implemented.

In the future there must always be a continuous program to maintain and periodically replace vitally important boundary fences, as well as a built-in system to detect and pursue goats which find an invasion route. Only in this way can native Hawaiian ecosystems be maintained in Hawaii Volcanoes National Park.

*This strong growth within a fenced test area at Kukaalauula illustrates how much damage goats can do as well as how successful vegetation recovery can be once the goats are removed. The predominate plant cover inside this fence is a previously unknown Hawaiian bean (*Canavalia kauensis*).*

This pair of photos illustrates recovery in the Kaone area. The top picture was made in 1971 when the hillside was so bare and dry the running goats raised dust. The lower photo, made in 1975, shows good vegetation. All photos were taken by the author.

More Countries Ratify Wetlands Convention

As of mid-June, 11 countries had become parties to the "Convention on Wetlands of International Importance, Especially as Waterfowl Habitat" which came into force last December 21.

The United Kingdom of Great Britain and Northern Ireland ratified the Convention on 5 January 1976, which action also covered Antigua, the Bailiwick of Jersey, Belize, Bermuda, Cayman Islands, Falkland Islands and Dependencies, Gibraltar, Montserrat, Pitcairn Islands, Saint Helena and Dependencies, Solomon Islands, Turks and Caicos Islands and Brunei.

Switzerland ratified the Convention on 16 January, while the Federal Republic of Germany's action came on 26 February.

Inventory of Park Resources

The second article in our series on masterplanning will appear in the third issue of PARKS Magazine. The subject will be the resource information base for planning. Pierre Des Meules, one of Canada's foremost planning experts, is preparing the article. Until very recently Mr. Des Meules was chief of the Applied Research Division, Parks Canada. He has transferred to the Canadian Wildlife Service, Quebec.

PARK PRACTICE

Trail Construction

In most national parks it is generally impractical and undesirable to develop extensive foot trails of an elaborate nature. Simple but well marked tracks through wild country, or hardened paths for routine occasional use by men and horses normally will serve their purposes quite adequately.

There are, however, certain trail locations where development to a fairly high uniform standard should be considered. Park managers will quickly identify these locations as those where heavy and usually short-distance use is normal—as between an auto parking area and a popular overlook, for example. Well constructed trails will be safer to use, and usable by more people. They will provide better protection of the areas crossed and require less maintenance. Ideally, these trails should look as if they had always been there, an integral part of the landscape.

It is always a wise precaution to review proposals for any development where excavation and construction are involved with experts who can assess the possible effects of the planned work on the environment. Where damage may occur to wildlife and its habitat, to historical or archaeological areas, to special botanical values, or to other irreplacable resources, the planned project should, of course, be cancelled or modified to preclude such unacceptable impacts.

The following notes, drawings and guidelines on the design and construction of trails were adapted by the editors for PARKS Magazine from the Park Practice Program publication, *Design*, issued for the last quarter of 1975. These remarks apply primarily to temperate regions.

A basic step in constructing a trail is to "line out" or mark the width along the path from start to finish. See sketch 1. Both sides of the planned trail should be staked, the distance between them depending on the steepness of the land and anticipated uses. On hillsides with one-to-one slopes, or slopes of steeper grades, a good width on solid earth would be about 1.25 m (4 feet). See sketch 2. Where no slope exists, line out in accordance with sketch 3.

Stakes should be well-placed so that there is no question about where the trail is to be cleared and excavated. This is particularly important on curves. When the entire trail has been staked you can begin to clear the area of brush and small trees, but remove only those which absolutely must be sacrificed for the minimum recommended trail width.

As for the linear grade of the trail, about 15 percent should be regarded as the maximum.

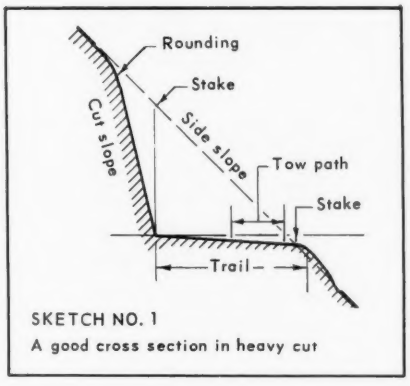
If handicapped or elderly people are expected to use the trail, gentler grades of no more than 5 percent should be used, and there should be no obstacles such as stairs, stumps or other impediments. Rest areas with places to sit should also be installed at intervals.

Excavation

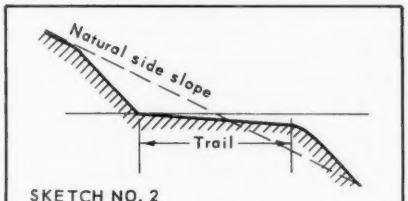
A narrow work path is cleared along the line formed by the outside stakes and excavated back about 50 cm (18 inches) See sketch 1. This path establishes the line for excavation of the remainder of the trail and its grade. If alterations need to be made, less time is lost and less damage done than if the entire trail were graded. The next step is to excavate to the full width.

The slope of the banks must then be considered. See sketch 4. The top of the slope, point "A", should be marked or staked on the ground and the slope cut straight from "A" to "B". The slope below the trail is then finished with fill and feathered down to the natural grade.

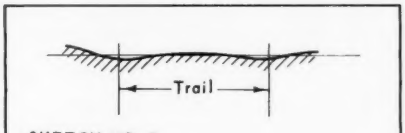
There are two primary objects in sloping banks: (1) it is a particular aid to the control of erosion in that it establishes slopes that are more nearly natural, thus enabling vegetation to catch quickly and cover the new cut and fill surfaces; (2) it reduces the possibility of damage through the action of frost and rain. Sketch 5 shows the action of frost on a poorly constructed trail. The combined action of water and frost at "A" and "B" loosens the material which drops to the trail, in some cases to such an extent



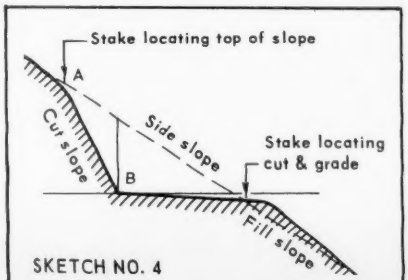
SKETCH NO. 1
A good cross section in heavy cut



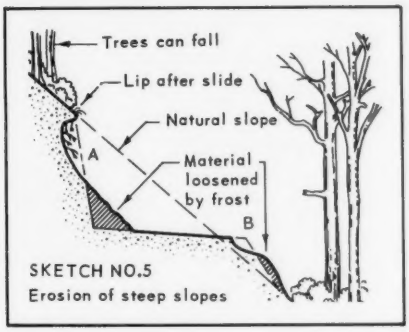
SKETCH NO. 2
For easy slopes



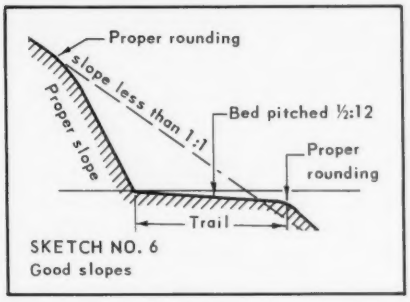
SKETCH NO. 3
For flat ground



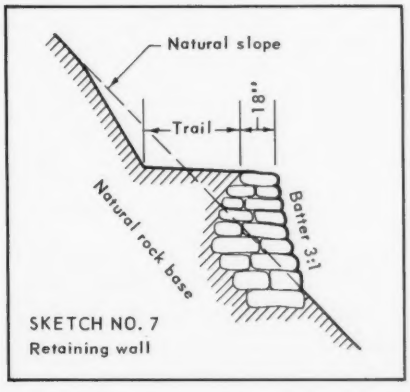
SKETCH NO. 4
Staking it out



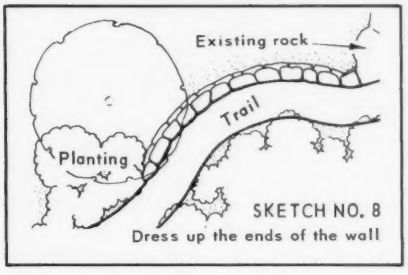
SKETCH NO.5
Erosion of steep slopes



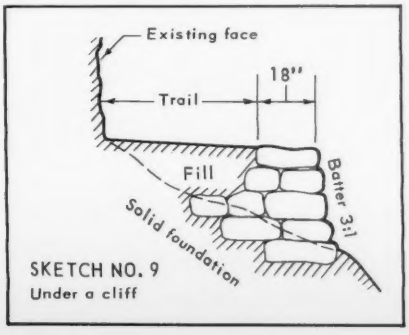
SKETCH NO. 6
Good slopes



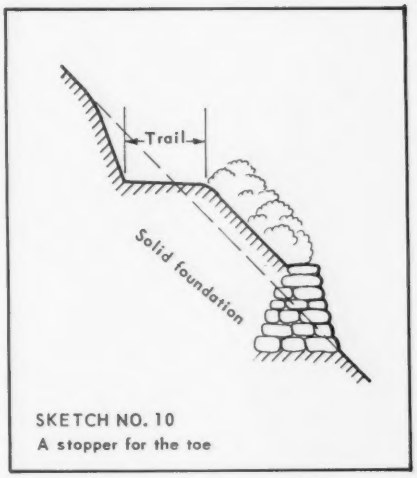
SKETCH NO. 7
Retaining wall



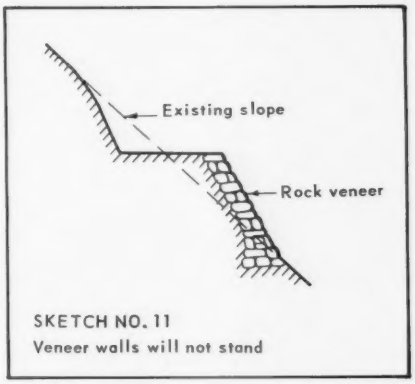
SKETCH NO. 8
Dress up the ends of the wall



SKETCH NO. 9
Under a cliff



SKETCH NO. 10
A stopper for the toe



SKETCH NO. 11
Veneer walls will not stand

that the trail becomes impassable.

Sketch 6 illustrates an ideal trail section, well finished, with banks and trail surfaces properly sloped and corners of cuts and fills properly rounded.

The question of how far to cut back a slope (or bank) is often a problem. Where the trail crosses a gently sloping hillside the bank may be taken back on a 2-to-1 slope, that is, 60 cm back for each 30 cm in height. A 1.5-to-1 slope is good, and a 1-to-1 slope should be regarded as the maximum, although there may be exceptions. Care should be taken not to remove too much established plant growth by grading too far up steep banks.

It is sometimes difficult to keep a slope uniform along the trail when the bank varies in height. If the slope is to be 2-to-1, measure the height of the bank, then measure back twice this distance from the vertical face of the cut, and set your slope stake. These stakes should be set from 1.5 to 3 metres apart to maintain a smooth, uniform slope.

Wall construction

A natural slope is preferable to wall construction but walls are necessary in many situations. Great care should be taken in their construction. See sketch 7. To assure solid construction and good appearance the following rules should be followed in the selection and setting of rock. Start the construction with proportionately larger rock at the bottom of the wall; grade the size to smaller rock in the center section and again increase the size toward the top of the wall. The top course of the wall should be of rock sufficiently large to be solid. The following method of wall construction has been used with good results.

1. The outside edge of the base of the wall is carefully staked along the route of the trail.

2. Vertical batter boards as a guide to the slope of the wall during construction are set at intervals along this line at the proper slope. It has been found advisable to allow about 5 cm (2 inches) of clearance between the batter board and the wall surface. Care should be taken in placing the batter boards to see that the top of the wall is located to give the proper width of trail when the job is finished.

3. After the batter boards are set, excavation is started. Wherever possible, walls should be built on a natural rock foundation; if this is not present, excavation should be made to solid earth, below the frost line, before any wall construction is begun. Never build walls on filled earth bases.

4. Where the trail is built on earth-fill back of the rock wall, the wall should be built to the following dimensions: the base of the wall should equal one-half of the height. The front face of the wall should be battered about 23 cm (9 inches) to the metre (39 inches) in all cases. The back of the wall should be built in steps starting at the bottom and finishing at the last course with a width of wall at least 45 cm (18 inches). See sketch 7.

5. Particular care should be given to locating the beginning and ending of the wall. Wherever possible the wall should begin and end in some natural formation, leaving no sharp ends exposed above the natural surface. Where this is not possible, arrangements should be made for planting with native materials to obliterate the ends of the wall, as in sketch 8.

Sketch 9 shows a typical walled section where the entire trail width is obtained without going into the side slope and creating a large scar. This is particularly useful in very steep hillsides and in places where outcroppings of rock must be avoided.

Sketch 10 illustrates a type of wall used where it is necessary to drop below the line of the trail to find firm foundations for wall construction. The slope between the top of the wall and the trail grade is built similar to the fill slope on the trail in ordinary circumstances. Care should be taken to provide for drainage above the wall.

Sketch 11 indicates a type of wall that is not practical as it can be washed out or turned over by frost action. It is merely a rock veneer and cannot be depended upon to retain a fill where there is pressure against it.

Sketch 12 indicates a wall on the cut side of the trail serving to retain loose earth and rock above the trail floor. This may be justified in a few exceptional cases. As a rule, however, wall construction above the bed of the trail should be avoided, as well as any laid-up work above a trail such as veneer construction to eliminate a hole in the upper bank where a stump has been removed. Where it is necessary to stabilize a bank above a trail it may be done by placing the rock in such a manner that it gives the appearance of a natural outcropping. This area should be planted in a natural manner, using native plant materials, down to the trail edge.

Where trails pass close to large trees and the location is kept below the tree, the type of construction shown in Sketch 13 should be adopted. This will make it possible to build the trail to the proper grade and location without injury to the tree roots.

Trail Width

The anticipated intensity of use will determine the required trail width, of course, but 1.25 m (4 feet) is probably adequate for most trails. This width should not be measured out to a sharp edge which is not substantial. It should be measured from the outside of the trail where the fill slope starts to round over, to a point just out from the base of the cut slope, allowing for rounding out at point "A". See sketch 14.

Where there is a wall on the lower side of the trail, the width should be measured from the inside of the wall. The top of the wall should not be included in the width of trail.

Where there is a steep dangerous drop-off below the trail, the trail width should be increased to 2 or 2.5 m (7 or 8 feet), exclusive of wall width. If pack animals or or horses are permitted on the trail there should be at least 30 cm (1 foot) clearance beyond each side of the trail. This distance may be increased where there is a dangerous condition below the trail. Tree branches that overhang the trail should be removed to permit passage of horseback riders. See sketch 14.

Drainage

No factor in trail construction is more important than proper drainage. Many sections of good trail are damaged and destroyed by erosion which could have been prevented. All drainage should be planned well ahead of construction. The method of carrying surface water off of each trail section should be determined, along with the location, type, size, and construction details of all drainage structures.

Three general drainage conditions are encountered in trail construction: **sheet water, water concentrating in natural basins, side drainage,** and **water in natural channels.**

Sheet water. Where water comes to a level section of the trail from an uphill slope it usually does not concentrate in drainage channels, but flows across in a sheet. In rare cases it is permissible to concentrate sheet water by cutting hidden ditches across the hillside, with an open ditch bringing the water to a culvert under the trail. *The approved practice is to pitch or tilt the trail bed* about 4 cm to the metre (1/2 inch per foot) so as to carry sheet water across the surface with the least concentration, and thus with the least danger of erosion.

Water concentrating in natural basins. Foot trails may go uphill and down, or cross ridges which shed water, and hollows which collect it. These hollows may concentrate water from a considerable area. The bottoms of these hollows, touching the trail, may be flat and wide, or steep and narrow. This topography calls for drainage structures, and the shape and area of a hollow dictate their location, type and size.

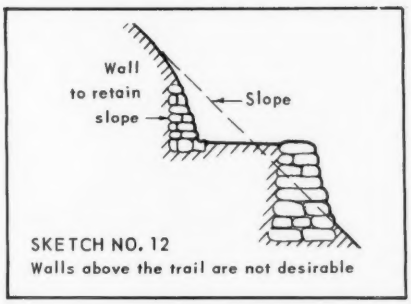
Surface water should not be forced to concentrate in channels to a greater extent than it does naturally. To compel it to back up behind culverts in new locations is to invite destructive erosion and unsightly ditches. Several small culverts should be used rather than one large one. The trail should also be raised enough to impound a rush of storm water until it can flow through the culverts, without cutting new channels in the drainage basin or across the trail.

In gullies, nature has already determined the type of structure to be employed, a culvert big enough to carry all the water that comes down. The gully has already established a temporary balance between the scour of the stream and its bed. This balance should not be disturbed, so the floor of the culvert should be at the level of the gully bed. Then the elevation of the trail, compared with the elevation of the gully bed, may dictate a wide, shallow culvert, or a deep, narrow one. But the wider the culvert the easier it will take water, and the less danger there will be of destructive cutting on the discharge side.

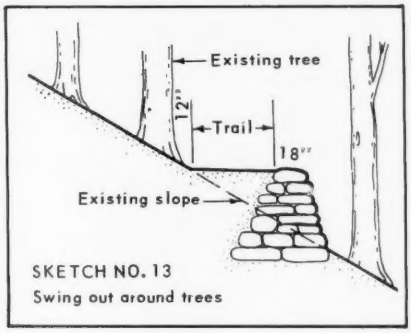
In many places where a small culvert seems to be needed it might be better to build a low-water crossing, which is merely a depressed section of the trail paved with flat stones.

Side drainage. Sometimes it is necessary to drain a trail surface to the inside, against a bank, providing a catch basin at the end of the culvert. Draining a surface in this way should be avoided if possible, but where it is necessary the side ditches should be paved with flat stones to prevent undermining. See sketch 15.

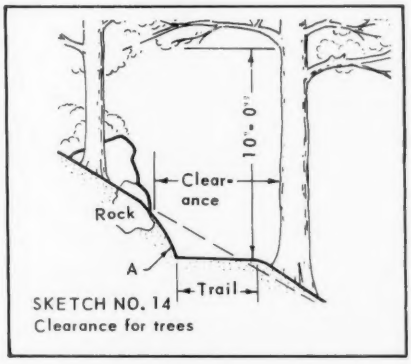
The only particular requirement for this type of culvert is to carry the catch basin well into the bank to keep it away from traffic. The back wall of the catch basin should be carried far enough up the slope to prevent erosion around it.



SKETCH NO. 12
Walls above the trail are not desirable



SKETCH NO. 13
Swing out around trees

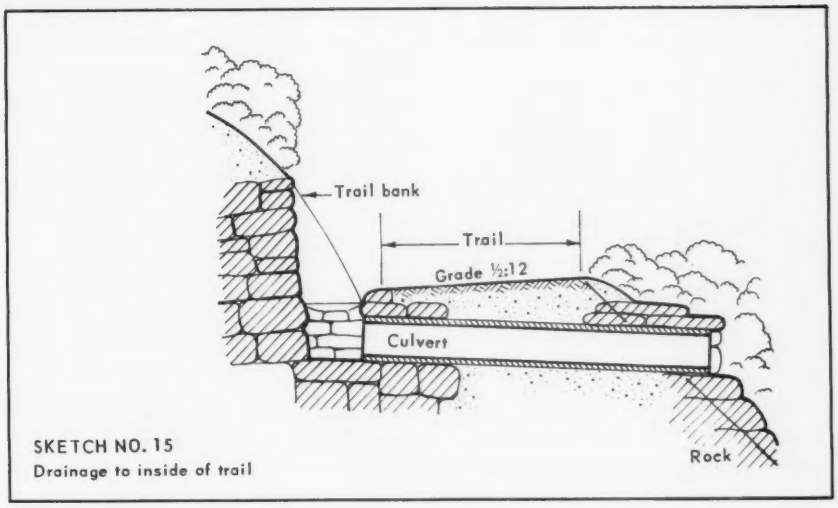


SKETCH NO. 14
Clearance for trees

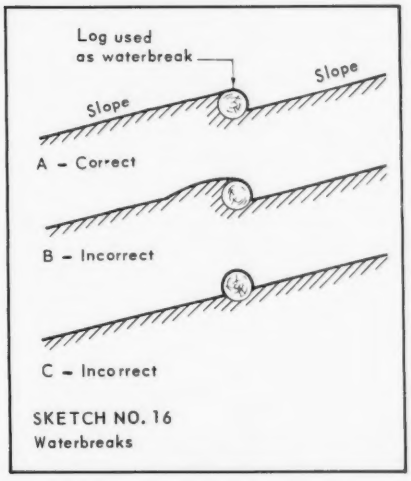
Water in natural channels. Established channels determine the location of culverts, and the amount of water to be moved can be estimated with reasonable accuracy. Any depression, even one coming from a small spring, is the established drainage channel in that area. This can be proved by the absence of erosion and the presence of cover on nearby surfaces. The amount of run-off at flood stage can be estimated by lines of drift left by high water, scouring at the bases of trees, root systems exposed by scouring, and other signs.

The culvert must be large enough to carry flood water, and its floor must be at the level of the channel bed. These two factors determine the size and shape of the structure. Where there is any choice, the culvert should be wide rather than deep. In some situations a bridge rather than a culvert will be required, but bridge construction cannot be treated in this brief article.

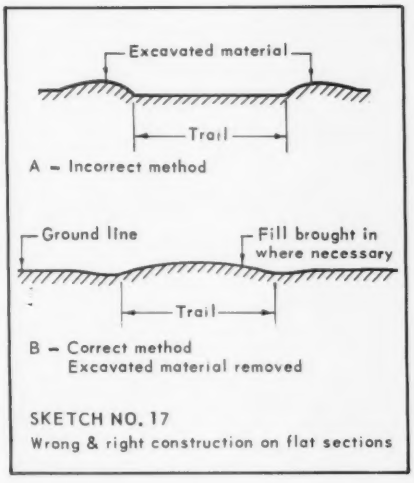
If the drained slopes are bare, and erosion is to be retarded until cover grows, a



SKETCH NO. 15
Drainage to inside of trail



SKETCH NO. 16
Waterbreaks



SKETCH NO. 17
Wrong & right construction on flat sections

catch basin can be built at the intake end of the culvert, with dry walls built high enough to form an impounding basin behind them, where the flood water can deposit its silt before seeping into the culvert. But in such a case special care must be taken to protect the culvert with wing walls, so that impounded water will not find a passage along the walls of the structure and eventually wash out the trail.

Types of culverts. Culverts may be preformed of concrete or steel, or made of timber, or stone using dry or mortar joints as prescribed by plans, general instructions or local conditions. In stone construction the ends of the walls should be flared, as a usual practice, to hold the fill above and to prevent scouring by flood water. Care should be taken to keep inside surfaces uniform and smooth to prevent debris from catching. A culvert should extend 50 cm or so (a foot or two) beyond the edge of the trail on each side, and the trail widened to the head walls of the culvert. The bottom level of the culvert should slope downward along its length not less than 1 cm in 30 (3/8 inch to the foot).

Waterbreaks

A waterbreak placed at intervals across trails should be extended far enough into the bank on the upper side of the trail to prevent water from cutting around it. It may be necessary to cut a notch into the bank to accomplish this, tamping the dirt back afterward. Both ends should be anchored behind rocks or trees, or firmly staked in place. See sketch 16.

The pitch of a waterbreak, or the angle at which it lies across the trail, is very important. A definite relation between the slope of the trail and the pitch of the waterbreak must be established by experience in each location. This relation depends upon the nature of the soil, and it may vary greatly on different sections of the trail. On one section there may be a stiff clay which does not wash. On another stretch there may be alluvial soil which will wash badly.

As one of two extremes, take a section in tough clay on a flat slope. Here there is very little danger of washing, and the breaker can lie on a steep pitch carrying off all of the water quickly. If it were laid on a flatter pitch, there would be danger of silt depositing behind the breaker which would put it out of use.

At the other extreme, consider a section in alluvial soil on a steep slope. Washing will occur here on the slightest incline, so the breaker must lie almost straight across the trail. If it is given a more pronounced pitch the water will hit the breaker, turn, and wash a cross-ditch. The breaker log may be washed out too, and the water will go on down the trail, making an additional load for the next breaker to carry off.

The spacing of breakers cannot be determined by any rule, but there are three particular locations where they should be placed: (1) where there is a depression or wash, the breaker should be set below; (2) on sharp curves, the breaker should be set at the uphill entrance of the curve; and (3) at changes in the trail grade, the breaker should be set just above the break in grade.

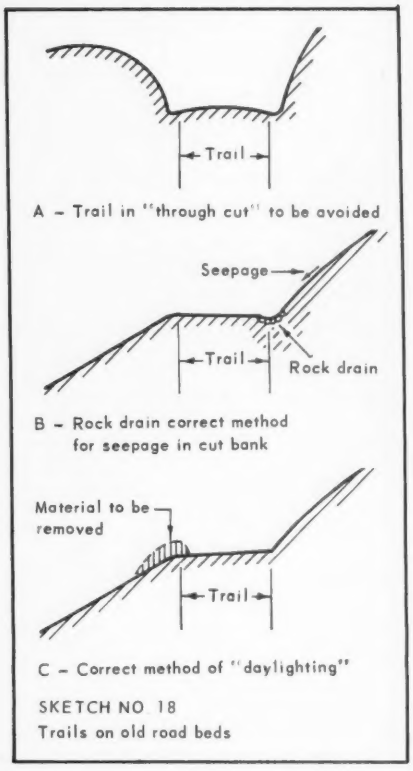
No harm is done if some excess water goes over a breaker that is carrying a full load off to the side. It is better to set them so that this occurs in heavy downpours than to pitch the breakers so that excessive scouring occurs alongside the logs. If careful study is given to the behavior of breakers in different soils, and on different slopes, it will be possible to reach a reasonable balance between scouring, as one extreme, and silting up, as the other.

In sketch 16, "A", "B", and "C" indicate three methods of setting breakers. "A" is the correct method with the grade below the breaker finishing flush with the top of the log. When setting, it is better to fill rather full back of the breaker and then tamp the soil well to prevent settling and the consequent exposure of the breaker. The grade above and below the breaker should feather nicely into the grade of the trail and not leave a "bump" as shown in "B". When breakers are set in this manner they are secure and not visible when one looks up the trail.

"C" indicates a method which is not desirable. It is not as secure, is more noticeable and creates an obstruction to stumble over.

The following are frequently encountered conditions that require careful study to secure proper drainage.

On ground where there is no appreciable cross slope, the trails often are incorrectly built as shown in "A" of sketch 17. Turf is cut from the trail floor and raked off to the sides, making piles that confine water to the trail and wash it out. On such locations, the proper method of construction will usually be to work out shallow, rounded depressions, not ditches, at the sides, and the good soil from these excavations used to slightly raise the level of the trail forming a dry, well drained surface in wet weather. In some cases it will be necessary to gather additional fill from another section to raise the trail floor. Drawing "B" in sketch 17


Trail
A – Trail in "through cut" to be avoided
Seepage
Trail
Rock drain
B – Rock drain correct method for seepage in cut bank
Material to be removed
Trail
C – Correct method of "daylighting"
SKETCH NO 18
Trails on old road beds

indicates the correct method of construction in this type of topography.

Water should be directed away from these drainage depressions wherever conditions will permit.

Sketch 18 indicates types of construction used when trails follow old road or railroad grades.

"A"—This sketch indicates the method used in "through cut" sections. It is not a desirable solution, however, and should be avoided wherever possible.

"B"—This shows a condition frequently encountered where there is a seepage of water for some distance from the bank above the trail which will keep the trail continually wet if the water is not disposed of satisfactorily. Here the trail is raised and the seepage caught in a rock fill which should extend along the trail for the distance that the seepage exists, and from there connect with one or more culverts.

Mounds of earth similar to those shown in "C" should be graded off.

Securing firm trail foundation

Trails should not be built on top of peat or beds of leaf mold. When this condition is encountered the entire depth of soft material should be excavated to make a solid base that is well drained and will remain solid. The leaf mold and peat removed should be used as topsoil along other parts of the trail and for planting operations.

Trail finishing

How far should one go on trail finishing? Generally, refined grading is not practical. Most trails will probably receive a relatively small amount of maintenance. The best answer to this question is that trail finishing should be carried to the point where erosion will be discouraged and natural plant growth will be encouraged. Such finishing can be justified from the practical standpoint. All trails will require occasional maintenance to keep them in good condition, and finishing them to hold upkeep to a minimum is one of the guiding factors in good trail construction. When banks are not properly sloped, walls not well built, and drainage not properly provided, constant maintenance will be necessary and the cost of upkeep will increase.

Subsequent articles will deal with specialized trails often used in parks, interpretation on trails, signs and markers, and related subjects.—Ed.

"Language paddles" at the Lowes

These are adaptations of a convenient, inexpensive and widely-used method of supplying portable written information for small numbers of people. At the visitor centre of a Scottish Wildlife Trust reserve at Loch of the Lowes, they carry the text of the exhibition on one side and a brief description of the Trust on the other. Translations into French, German, Danish and Spanish are available. The "paddles" are positioned inside the Centre door so that the relevant word (Francais, Deutsch, etc.) catches the eye of the incoming foreign visitor.

The Lowes paddles consist of a plywood "blade" (hexagonal in shape since hexagons appear as a motif throughout the exhibition) and a handle, resembling that of a table tennis bat, made from a broom handle. Size is determined by convenience of handling, and the length of text to be accommodated. For storage the "paddles" are held in standard broom handle clips, but they could be kept in shallow bins, racks, or on a narrow horizontal board with holes drilled to accommodate the round handles. The heavy quality paper carrying the text was glued onto the "paddles" and given two coats of clear varnish.

These Scottish Wildlife Trust examples cost under £5 for four, as they were made as a school project. A technical class made the "bats" or "paddles", modern language students and staff translated the text, and the commercial department did the typing. Text and photo: Valerie M. Thom, Countryside Commission for Scotland.

Something for the Children

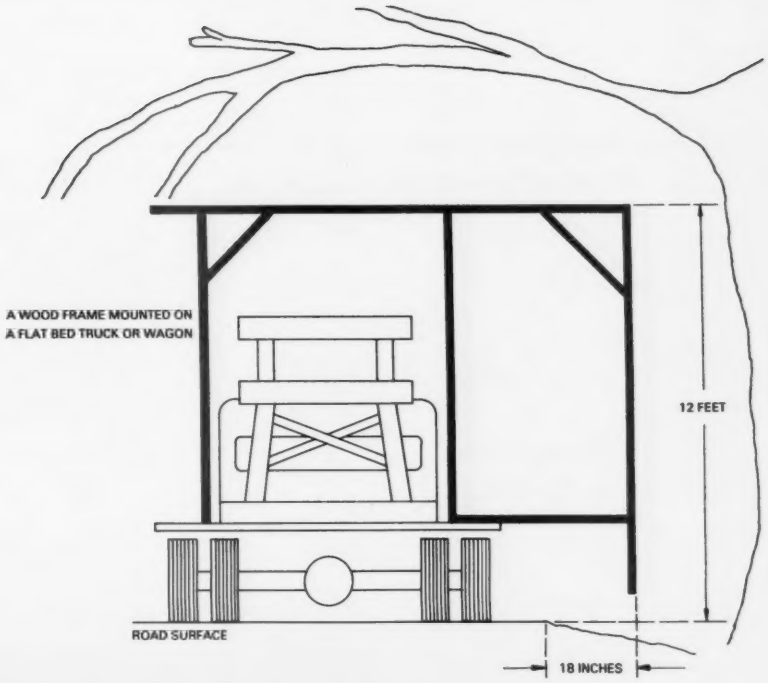
Very small children usually are not able to reach the top of a standard picnic table. A simple elevated bench securely fastened between somewhat longer side benches solves the problem. Photo: Coleen A. Spica, USNPS.

Tree Trimming Guide

Pruning overhead and roadside tree branches evenly can be very difficult. Often results are unsatisfactory because there is no guide or line to follow. This can be overcome by means of a simple fixed guide mounted on the back of a truck or wagon. With this guide the trimming lines can be maintained without difficulty.

The guide is a wood pole or timber frame installed on a wagon and braced to a level of about 12 feet (3.5 m) above the road surface, with a right side guide extending far enough from the wagon to take in 20 inches (50 cm) of the edge or shoulder of the road. A work platform was then mounted in front of the guide on which a man can work freely to prune the limbs. In practice a 6 foot (about 2 m) lifeguard stand was found about right. The stand is roomy enough for a man to move around and work without the danger of falling off. It gives him a place to put his tools when not in use as well as a place to sit.

This idea was worked out by Resource Conservation, and General Works, Parks Canada.

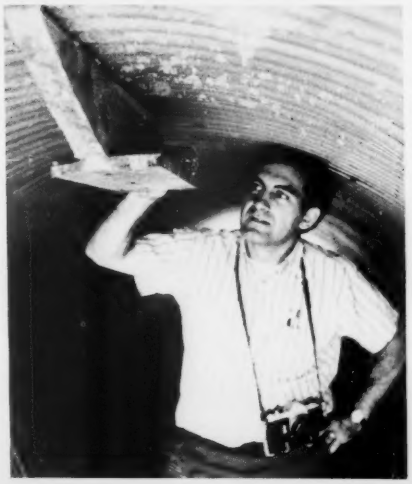


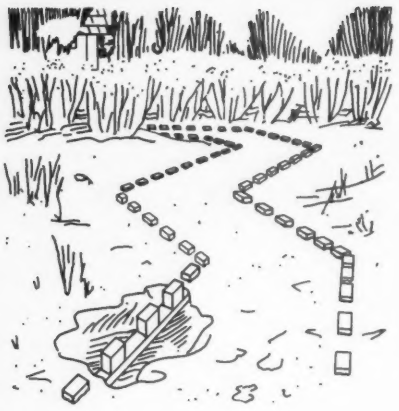
"Welcome House"

For essential buildings in national parks and reserves, it is a good practice to use locally available materials, and follow architectural styles indigenous to the area. The visitor center at Varirata National Park, Papua New Guinea, provides an excellent example. Welcome House is constructed of 'bush' materials. The roof is made of kunai grass bent over saplings, while the walls are woven of split bamboo. The result is both pleasing and appropriate. A building of masonry, glass and metal would have been quite out of place. Photo: W.J. Metcalf and D. Teng, Papua New Guinea.

Something for the Birds

Nesting structures can often be mounted inside large culverts or under new bridges. The simple "T" formation shown here with its promoter, U.S. Biologist Gene Whitaker, would attract swallows and phoebes, whose favored nesting places include narrow shelves in barns, under bridges, and hidden ledges on man-made structures. Overall length of this nesting ledge is about 1 m. The shelf itself is about 8 cm in width on each side of the central support.





Marking Trails in Sand

Marking and maintaining a trail over soft sand can be very difficult, but this idea, used at the Chatfield State Recreation Area in the US State of Colorado, seems a simple and workable solution to the problem.

As the drawing shows, old cedar blocks were nailed at intervals of 15± cm to lengths of timber, each several metres long. The timbers were buried in the sand, leaving about half of each block exposed above the surface.

The trail is clearly indicated by the blocks of wood. The decay-resistant markers stay in place, and can't be moved or carried away by visitors or vandals without considerable effort.

Standing Up to an Exhibit

All too often the experts responsible for the design of exhibits in national parks apparently assume that visitors are either all the same height or will not mind stooping or stretching to see an exhibit.

In fact it seems generally accepted that 5 feet 2 inches (157 cm) is a magical viewing height from which most displays can be seen adequately by the average person.

Few adults are inconvenienced by this assumption; however we tend to forget that children form a large part of the population. Stretching, or standing on tip-toes, then, becomes part of what a child comes to expect when he or she is taken to an exhibition.

To be sure, some few parks and institutions have provided shorter drinking fountains and other practical hardware designed to serve little people. Unfortunately, however, we sometimes adopt a lofty attitude to educational exhibits. This may reflect a belief that children will not fully comprehend what we are trying to say in any case.

It may be thus that we deprive ourselves of a truly appreciative audience, for children can offer new insight for the exhibit designer as well as objective criticism. In many respects, the look of comprehension in the eyes of children is reward enough to the serious exhibit designer.

However, eyes must perceive to comprehend and it behooves us to make this not only possible, but easy to do.

The simple compensation for lack of height is a small step in the right direction. Which is to say a small step is most often all we need.

A diorama may be just a little too high for a small child to see. Showcases are usually far out of reach, and pedestals supporting sculpture can be nothing more than a barrier.

Protective walls in front of animal enclosures or other exhibits often completely shut out the little people the walls were designed to protect.

Aquarium tanks may be of little benefit to the child who has only a fish-eye view of the water surface.

Most of these viewing difficulties can be overcome. Steps and narrow platforms fronting certain barriers can provide a proper viewing height for children without interfering with the adults' view.

Holes or windows can sometimes be installed in safety walls.

Indeed, for some of the larger exhibits, raised platforms can be constructed for family viewing.

It is much easier to appreciate the hard work of exhibit planners while standing on one's feet than hanging from the tired arms of a dutiful parent.

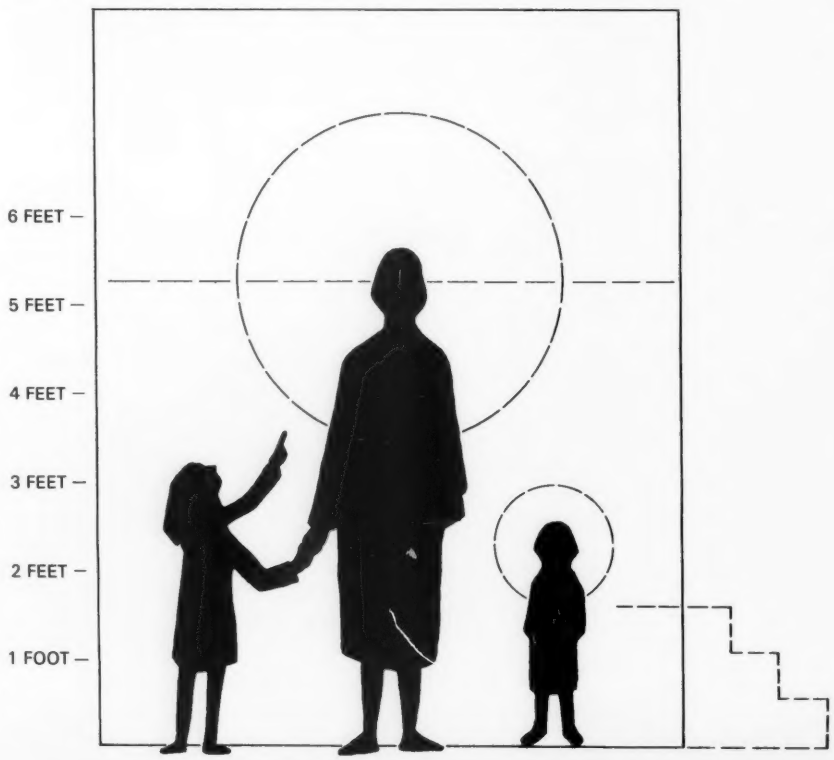
— R. M. Hume, Parks Canada

Frustrating Relic Hunters

Historic sites—particularly battlefields—are often a great attraction to unauthorized relic hunters.

Signs and other warnings are frequently ignored, especially when historic earthworks are involved. Relic hunters armed with portable electronic metal detectors, similar to the wartime mine detectors, are often the worst offenders. Stuart H. Maule, Superintendent of Richmond National Battlefield Park (USA) recently received an award for his idea to ward off the hunters. Maule suggested that iron buckshot or its equivalent be spread on historic earthworks to confuse and discourage unauthorized souvenir hunters. The readings on the detector would quickly discourage anyone using the device and the rust color which the iron takes on would blend into the earth so that it would not be seen.

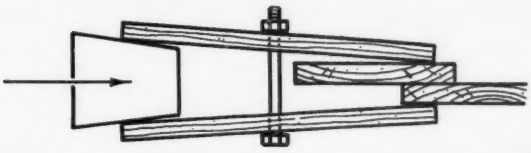
In practice, the iron shot is buried within 5 cm of the surface and careful records of its location are kept.



Simple Clamps for Many Applications

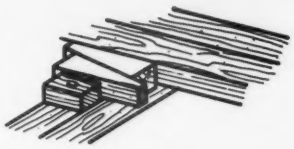
Carpenters and maintenance workers in parks and reserves frequently need tools they don't have. Often these are clamping devices needed to bring and hold parts close together until permanent fastenings can be made, or to exert pressure at some particular point during construction.

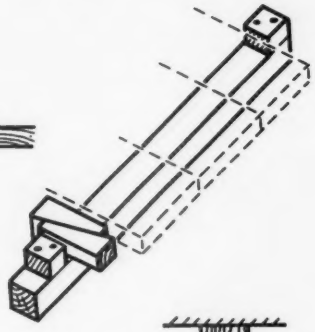
Here are several simple tools based on wedges and levers.

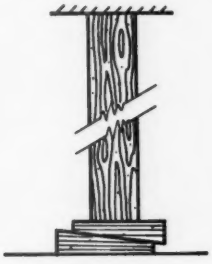


1. Two strong pieces of wood are loosely held together at the center. The center fastening could be a bolt, fibre cords or even rawhide. A wedge driven between the wood pieces at one end tightens the opposite end. The amount of pressure can be increased by moving the point of the center fastening away from the wedged end.

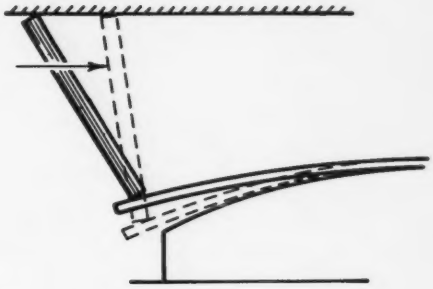
2. Simple wedges can exert great force. Here are several variations, including a pair of wedges driven from opposite directions to equalize the pressure.



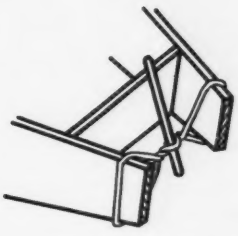




3. A brace started at an angle exerts great pressure when driven straight.



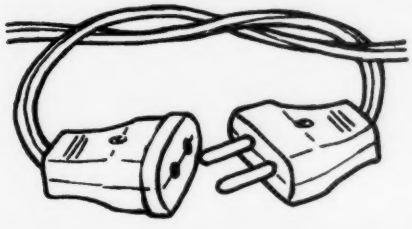
4. A loop, or loops, of rope twisted at the center with a short rod will pull two parts together. This device, often called a Spanish windlass, has a wide range of uses.



Drawings reprinted from Motor Boating & Sailing *magazine, February 1976 © 1976 by the Hearst Corporation, all rights reserved.*

A Firm Temporary Connection

There are occasions when an electric extension wire is not quite long enough to reach the point of use. As a *temporary* expedient, several extension cords or cables can be joined together. The connection illustrated will keep the cords from pulling apart. This idea is reprinted from *Grist* and was originally submitted by the Superintendent of Old Mill State Park in Minnesota, USA.



HELP!

People, organizations and libraries in more than 140 independent nations now receive a total of over 5000 copies of PARKS Magazine in one or more languages. The demand for the magazine has exceeded our expectations, and our supply as well.

Financial restraints prevent us from increasing the total number of copies we can print and distribute at present, but with your assistance we can better reach all who will benefit from this new publication. There are two ways you can help. First, if you are on the mailing list and do *not* need the magazine, please let us know so we can send it to someone who needs it. Second, please let others see and use your copy.

Your cooperation will be appreciated.

The Editors

PUBLICATIONS

World Directory of National Parks and Other Protected Areas
Compiled by the Secretariat of IUCN with the advice and guidance of the International Commission on National Parks (now the Commission on National Parks and Protected Areas).
International Union for Conservation of Nature and Natural Resources, Morges, Switzerland, 1975. 250 sheets, dividers, and binder, US $25, including shipping by surface mail.

The long-awaited *World Directory of National Parks and Other Protected Areas* was published by IUCN in the third quarter last year. Issued in looseleaf form, similar to the Red Data Books, the Directory provides essential data in synoptic form. As a ready reference, the Directory should be invaluable to writers, park managers, scientists and scholars, as well as for libraries, universities and other organizations dealing with national parks and protected areas. The data sheets are arranged alphabetically by country.

The Directory is based on information gathered by IUCN in its continuing task of monitoring the *UN List* and draws on more than 20 years' experience in this field. This first issue of 250 sheets covers 17 countries in Africa, Asia and Oceania, Europe, North America, and South and Middle America. The publication will be expanded as information on additional areas is processed each year. A second issue of additional countries and areas, expected to contain several hundred sheets, is planned for this year.

The book is a mine of information. An extensive preamble contains ten parts, including descriptive data on the various types of protected areas covered in the Directory. There are national parks and equivalent reserves, provincial parks and related reserves, strict nature reserves or managed nature reserves, multiple-use reserves (including forest reserves and certain game reserves) and anthropological, archaeological or historical reserves.

Criteria for inclusion in the Directory and in the UN List are given as well as essential definitions, and a list of Biotic Provinces described in greater detail in IUCN Occasional Paper No. 9.

The data sheets, which are the heart of the Directory, are simple, direct, and about as complete as one could hope for. Careful editing holds the data contained in 21 standard entries to the front and back sides of the sheet devoted to each area. Usual entries cover name, type, biotic province, date established, location, altitude, zoning, staff and budgets. More elaborate treatment is given to land tenure, physical features, vegetation, noteworthy fauna, disturbances or deficiencies, tourism, scientific research, special scientific facilities, and principal reference material. As a final helpful note, often absent in other publications, each sheet provides a mailing address for the local park administration.

The new Directory is issued in addition to IUCN's *UN List*, which has been produced in brief form annually since 1973.

More elaborate earlier editions of the *UN List* were issued in French, in 1967, with a revised edition in English in 1971, and an Addendum in 1972. These were prepared under the direction of Prof. Jean-Paul Harroy and the ICNP, and published by Hayez, Brussels.

The Directory was published with the financial assistance of the World Wildlife Fund and UNESCO.—*R. Standish*

Cyclical Maintenance for Historic Buildings
By J. Henry Chambers, National Park Service, U.S. Department of the Interior, 1975, Washington, D.C. 125 pages, US $2.00

The key to good preservation is regular and routine maintenance, for not only does maintenance inhibit deterioration of historic structures, but a maintenance man through his normal duties will spot incipient rot before it becomes a major problem.

For those administrators of historic houses who are concerned about the preservation of their structure, I recommend *Cyclical Maintenance For Historic Buildings* by J. Henry Chambers. Mr. Chambers, an architect in private practice who has been long involved in historic preservation, has written an informative and useful handbook that should be helpful to all those concerned with the managing and maintenance of historic structures. He gives a straightforward, non-technical exposition of the latest approved methods for taking care of old structures.

He feels that the first step in maintenance is good cleaning practices, and in his booklet Mr. Chambers details techniques of cleaning, evaluates the best equipment to use, and discusses the cleaning of various items from untreated wood to draperies. He gives accounts of historical methods of cleaning and evaluates their effectiveness. He also goes into modern methods that should be employed.

Maintenance of various portions of the structure, including masonry, exteriors, floor, and mechanical and plumbing systems is gone into, as is the care of items subject to wear, such as door latches.

Mr. Chambers advocates a systematic approach to maintenance, and toward this end he urges the drafting of a maintenance manual for historic structures to guide the people directly involved in this important aspect of preservation. He outlines the kinds of information the manual should contain and provides sample forms for analyzing maintenance requirements and for devising work schedules.—*F. R. Holland, Jr., USNPS*
This book may be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $2.00. Stock Number 024-005-00637-1

A Masai herdsman and his cattle at a water hole in Amboseli. The park's perennial waters are vital to all the region's animal life during the dry seasons. Photo: Robert C. Milne

Staff

EDITOR: Robert I. Standish, U.S. National Park Service

ASSISTANT EDITOR: C. Gordon Fredine, U.S. National Park Service

FRENCH EDITION EDITOR: Madeleine Doyon, Parks Canada

SPANISH EDITION EDITOR: Juan Villaverde, OAS-Washington

DESIGN: James True

Advisory Board

John I. Nicol, Director-General, Parks Canada

Gary E. Everhardt, Director, U.S. National Park Service

T. M. Pasca, FAO-Rome

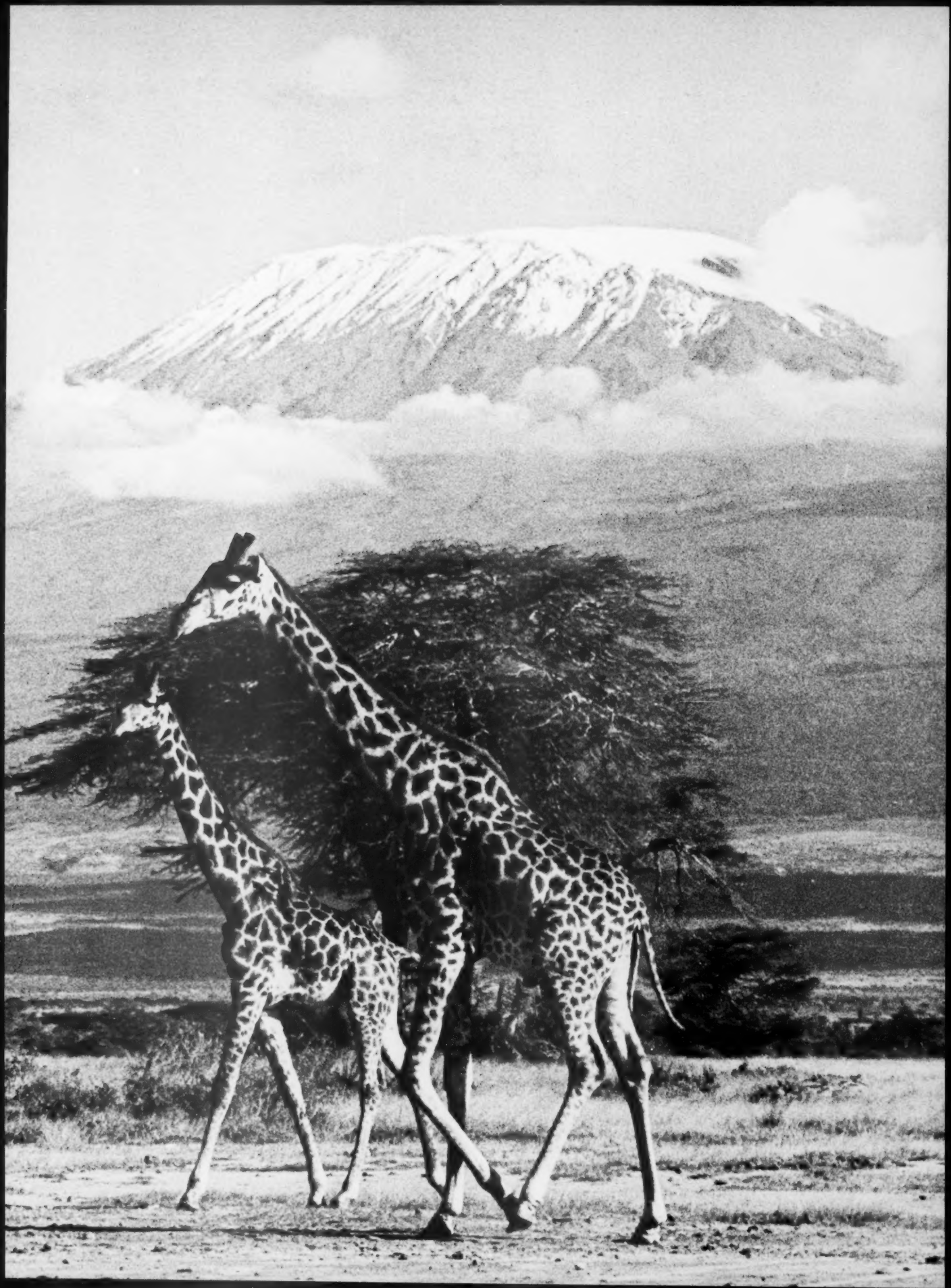
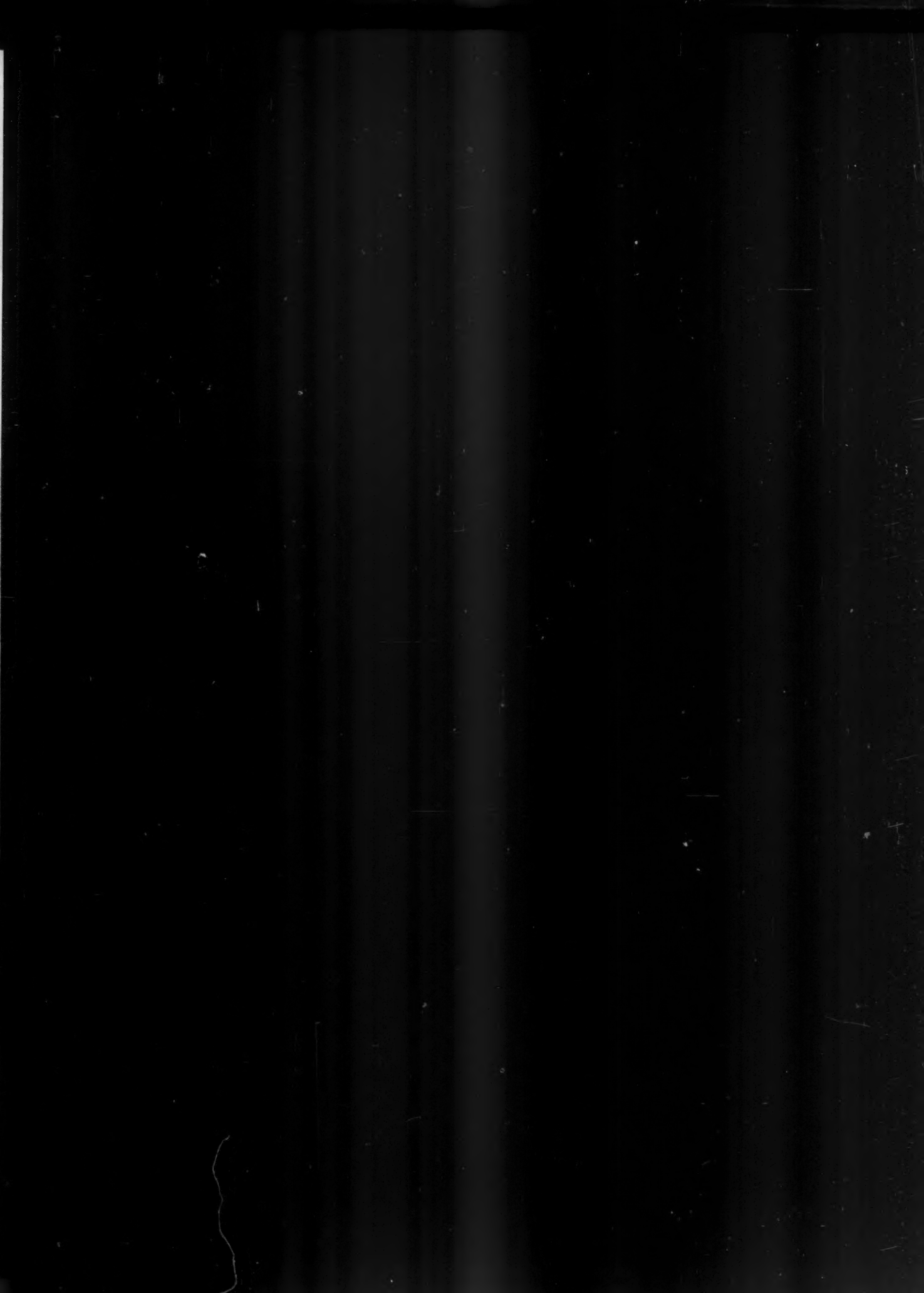
Dr. Michel Batisse, UNESCO-Paris

Braulio Orejas, OAS-Washington

Peter H. Bennett, Coordinator, Liaison and Consultation, Parks Canada

Theodor R. Swem, Chairman, Commission on National Parks and Protected Areas (IUCN)

Jean C. Henderer, Chief, Office of Cooperative Activities, USNPS

Robert C. Milne, Chief, Division of International Park Affairs, USNPS

Counsel: Robert M. Landau, Deputy Associate Director, Legislation, USNPS